



CITY OF GREENVILLE

**DESIGN AND
SPECIFICATIONS
MANUAL**

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EXECUTIVE SUMMARY

Historically the Engineering Division has maintained a book of engineering standards that consisted mostly of detail drawings that apply to the construction of utility and street infrastructure within the City. The latest version of the standards book was issued in 1988. As development requirements changed and new technologies and methods evolved, the manual was updated, or in some cases, sections were simply deemed inadequate and other publically available resources were adopted as policy. For example, the South Carolina Department of Transportation (SCDOT) and the South Carolina Department of Health and Environmental Control (SCDHEC) have stormwater and erosion control details readily available.

With the adoption of the Land Management Ordinance in January 2008 and the adoption of a new stormwater ordinance in February 2008, it became imperative to prepare a new edition of the Design and Specifications Manual. While some inroads were made prior to the adoption of these ordinances, a complete overhaul of the original document was still necessary. All of the bureaus of the Engineering Division (Civil, Environmental, Traffic, and Construction Inspection) have been involved in this effort, and while significant progress has been made, the full manual is not yet complete. However, it is the recommendation of the Engineering Division to adopt sections of this manual as they become available.

The purpose of the Design and Specifications Manual is to establish minimum standards and provide guidance for the design and construction of land development projects and utility installations within the City of Greenville. The manual will assist developers, engineers, surveyors, contractors, inspectors and property owners in the best practical design for site development and redevelopment activities.

This manual is organized to guide one from the conceptual planning stage through construction. The table of contents describes the purpose of each chapter that is currently undeveloped. As each chapter is completed, the table will be modified appropriately. Chapter 1 introduces the purpose and objectives of this manual. Chapters 2 through 6 provide an overview of the permitting process and general development requirements. Chapters 7 through 9 provide specific design criteria for the development of street and utility infrastructure. Chapters 11 through 13 describe the Engineering Division's role in the construction process. The appendices contain information critical to the design professional including pre-approved details and notes, the stormwater design manual, and current engineering forms and checklists.

The Engineering Division recognizes that this manual must be dynamic and must continue to evolve and adapt to new technology, materials, and experiences. As we continue to develop this manual in the light of new developments, we must be satisfied that our decisions are appropriate and will strengthen and enhance engineering. To do so will uphold our tradition of quality in the City of Greenville.

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revisions

August 2008:Initial release.

June 2010:Chapter 8, Wastewater Utility adopted and included into the specifications. Additional Wastewater Utility details added to Appendix A, 2000 Division, Wastewater Utility.

April 2012:Chapter 8, Wastewater Utility, revised to clarify warranty and bonding period. Updated warranty form and sample warranty bond included in Appendix D.

January 2013:Updated standard Erosion Prevention and Sediment Control Notes, Detail 39:00, in Appendix A.

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Chapter 2 PLAN REVIEW PROCESS

This chapter will provide an overview of the plan review process from the Engineering Division perspective. The different Bureaus and their responsibilities will be discussed. Permit Engineering Review and Tracking System (PERTS) will be introduced and the review timeline metric will be discussed relative to the overall site permit process. In addition, the plan review processes for delegated sanitary sewer plans as well as peripheral development elements like retaining walls and lighting plans will be discussed.

Chapter 3 AVAILABLE RESOURCES

This chapter provides an overview of the resources available to the engineer through the Engineering Division. For example, the Engineering Division Website, how to obtain a copy of this manual in paper as well as electronic form, the pre-design conference and how to schedule one will all be discussed. Also included in this chapter will be an overview of the materials used in the development of this manual.

Chapter 4 PROPERTY REGULATIONS

Property regulations will include a discussion of easement and right-of-way dedications, right-of-way abandonment procedures, and may include a discussion of subdivision regulations and plat review requirements from an Engineering Division perspective in future updates.



Chapter 5 PERMITTING RESPONSIBILITIES

This chapter will provide an overview of the city, state, and federal permits typically required for land development activity. Emphasis will be given to the city permits and the Engineering Division's role in their issuance and closure.

Chapter 6 GENERAL DEVELOPMENT REQUIREMENTS

This chapter will discuss general submittal requirements for most developments. Included will be a discussion of the role of the pre-approved details and notes included in the appendix of this manual. This chapter will discuss the sidewalk and curb lawn directive for new and redevelopment projects and the variance process. There will also be a discussion of the pre-design conference, the typical submittal set, the importance and thresholds for traffic impact studies, required maintenance agreements, work zone traffic control plans, a brief description of typical inspections through the construction process and for project closeout, warranty requirements, surety bond requirements, and as-built drawing requirements.

Chapter 7 STREET DESIGN CRITERIA

7.1 Overall Design Guidelines

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The full development of this chapter will provide a review of the overall design guidelines for street development and redevelopment within the City. Street classification will be discussed as will the general design elements (e.g. design speed, traffic and use considerations, vertical and horizontal alignment, sight distance, intersection design, pavement sections) for all streets within the City. Utility provider coordination and the process for accepting streets into the public network will also be discussed. Additionally, traffic calming, street naming, striping and signage, and lighting will be discussed. Finally, private street development requirements will be discussed.

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Chapter 9 STORMWATER DESIGN CRITERIA

While the full Technical Reference Manual, as referenced in the ordinance, will be included in the appendices of this manual, this chapter will provide a comprehensive review of the stormwater program requirements. The objectives for stormwater planning, stormwater quantity and quality considerations, and the preservation of natural creeks and streams will be discussed. General design considerations like hydrology methods, detention requirements, analysis of downstream system requirements, functional



design and design life of stormwater drainage systems and detention structures, and low impact development methods will also be presented. Finally, permanent maintenance agreements and facility access easements will be reviewed.

Chapter 10 RESERVED

Chapter 11 SITE CONSTRUCTION ADMINISTRATION

This chapter will discuss the preconstruction conference, inspection frequency, required submittals and notifications, erosion and sediment control monitoring, penalties for non-compliance, development certifications, and the bond release process as it relates to all projects within the City.

Chapter 12 SITE CONSTRUCTION ACTIVITIES

This chapter will discuss general measures that should be followed on all construction projects for success and for the safety and general welfare of the public. The role of construction phasing, good housekeeping and other BMP measures, waste management, maintenance of stormwater facilities during construction, notifications of spills and other releases, and emergency contacts will be discussed.

Chapter 13 RIGHT-OF-WAY & ENCROACHMENT MANAGEMENT

The encroachment permit process and enforcement measures will be discussed in this chapter. Driveway construction, temporary street and sidewalk closures, construction container management, and required forewarning signage will all be discussed.

Appendix A – STANDARD DETAILS AND NOTES

Appendix B – STORMWATER TECHNICAL REFERENCE MANUAL

Appendix C – STORMWATER POLLUTION PREVENTION PLAN TEMPLATES

Appendix D – ENGINEERING DIVISION FORMS

This appendix will include all current forms and checklists of the Engineering Division.

Appendix E – SELECTED CITY ORDINANCES AND POLICIES

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chapter 1

INTRODUCTION

1.1 Purpose

The purpose of the Design and Specifications Manual is to establish minimum standards for design and construction of land development projects and related infrastructure within the City of Greenville. The standards are intended to protect and promote the general welfare of all citizens and to support, through quality infrastructure and development, City Council resolutions for:

- Financially sound City with excellent services
- Livable neighborhoods with pedestrian oriented design concepts
- Responsibly managed quality development
- Vibrant downtown and revitalized corridors that preserve Greenville's identity

The Design and Specifications Manual will assist developers, engineers, surveyors, contractors, inspectors and property owners in the best practical design for site development and redevelopment activities within the City and promote functional and sustainable low impact initiatives.

1.2 Goal

Major objectives for the Design and Specifications Manual are focused on providing sound, responsible infrastructure satisfying federal, state, and local requirements permitted through the City of Greenville Engineering Division. Goals of the manual include:

- Design/construction of safe and durable streets, driveways and parking lots
- Design/construction of durable wastewater systems with respect to design life, capacity, and pollution mitigation
- Design/construction of stormwater drainage systems to reduce flooding and other drainage problems
- Reduction and control of stormwater pollution through good design features
- Properly planned and installed measures for erosion prevention and sediment control
- Complete and accurate plans to ensure grading, property, and utility issues are addressed



I.3 Scope

The scope of the Design and Specifications Manual is limited to the procedures and criteria for the design and evaluation of wastewater and stormwater utility, streets, land development plans, and related infrastructure. The manual also includes City of Greenville standards for construction, an explanation of the construction inspection process, and the requirements for successful project completion.

The Engineering Division is one part of the City of Greenville review process, as explained further in Chapter 2. As such, the Design and Specifications Manual does not contain the complete requirements for site development design and construction, and should be used in concert with the Land Management Ordinance. Also, building design and construction is governed by the adopted standards of the Building Codes Department, which are not presented herein. Moreover, the design professional should be aware of regulatory requirements of Greenville Water System, Western Carolina Regional Sewer Authority (WCRSA), South Carolina Department of Health and Environmental Control (SCDHEC), South Carolina Department of Transportation (SCDOT), Army Corp of Engineers, and other entities that may apply to the proposed work. In addition to technical design, submitted projects must also meet federal and state standards for health and safety like Occupational Safety and Health Administration (OSHA) standards, American Association of State Highway and Transportation Officials (AASHTO) requirements, Federal Highway Administration (FHWA) regulations, and United States Access Board (ADA) guidelines.

The design professional is encouraged to employ the pre-approved, standard details and notes that are provided in Appendix A. The pre-approved standards are to be referred to by any individual or company designing, constructing or maintaining wastewater utility, stormwater utility, street improvement, and land development related infrastructure in the City of Greenville. The pre-approved standards meet federal, state, and local requirements; they follow sound, responsible, and current engineering practice; their use will expedite the review process; and they establish a standard of responsibility, clarity, and professionalism to be incorporated into all design. Every detail has been prepared with a key understanding of the land development process, and each has been authorized by the City Engineer. However, these standards are not intended to replace the judgment of the design professional who must thoroughly investigate field conditions and coordinate all design efforts.

The Design and Specifications Manual is not intended as a textbook or a comprehensive engineering design reference. Most types of engineering calculations are not explained or defined either due to the very complex nature of the subject matter or the fact that the design equations and methods are well-known to most competent practicing engineers who claim expertise in the area of land development.



I.4 Design Flexibility

The intent of the Design and Specifications Manual is to ensure that minimum standards are met with respect to development and redevelopment. These minimum requirements shall be enforced in a fair and impartial manner based upon sound engineering judgment and the objectives described herein. The design standards are presented with the realization that every case will not be covered. Unique conditions may preclude the practical application of the standard details and/or design criteria. Moreover, new technology, products, and techniques are encouraged and may be specified with approval of the City Engineer.

The design professional, along with the project owner, development team, and contractor, are strongly encouraged to schedule a pre-design/pre-permit conference with the City Engineer to discuss the project scope and permitting requirements. The design professional must make every reasonable effort to meet the guidelines set forth in this manual, but in the case of restrictive conditions unique to the development parcel, deviations from the standards may be made with approval of the City Engineer. If the City Engineer and the design professional can not agree on a reasonable exception to the design standards, application for a variance may be made to the Planning Commission. Rules and application forms may be obtained from the Planning and Development Office if a variance is necessary.

I.5 Authorization

The Land Management Ordinance, effective January 2008 and as further amended, defines the applicability of this manual to the land development process. Other types of design procedures have been in effect for many years through policy mandates issued through the City Manager by City Council. City ordinances and resolutions also impact project design and have been considered herein. Moreover, SCDHEC delegated review authority provides much of the basis for wastewater utility design, and the Stormwater Ordinance, effective February 2008 and as further amended, provides the basis for much of the stormwater design criteria.

The City of Greenville, like many other cities across the United States, is required to have a National Pollutant Discharge Elimination System (NPDES) permit to discharge stormwater from the municipal separate storm sewer system (MS4). This requirement comes from the Clean Water Act administered by the U.S. Environmental Protection Agency (EPA). Because development activities contribute to the discharge of pollutants, the NPDES permit requires that the City of Greenville encourage, promote, and require implementation of certain practices and procedures for the purpose of reducing or limiting discharge of pollutants to stormwater channels. City ordinances and standards were developed and adopted specifically to address stormwater quality concerns. The Design and Specifications Manual is an important element in the City's effort to improve and promote consistent environmentally respectful residential and commercial design and construction practices.



1.6 Land Development Design Objectives

Design objectives of projects constructed in the City must include:

1. Safe and functional design of roads, streets, driveways, and parking lots.
2. Safe and functional design of sidewalks, walkways, trails and other pedestrian routes.
3. Safe and functional design of stormwater inlets, culverts, pipes, open channels, and other conveyance.
4. Minimize flooding, interruptions of utility service, traffic inconvenience and potential water damage to residences and businesses.
5. Minimize the amount of public expenditures needed for maintenance of streets, wastewater systems, and stormwater facilities.
6. Minimize the amount of public expenditures needed for flood control projects and flood relief efforts.
7. Promote appropriate design life of wastewater systems and mitigate exfiltration and infiltration of the system.
8. Preservation of trees, woods, natural meadows and other green spaces as much as possible (in conjunction with allowable land uses and zoning codes).
9. Protect and enhance streams, wetlands, waterways and rivers for wildlife and plants by reducing stormwater pollution, erosion, and negative stormwater impacts.
10. Promote development of recreational facilities and design aesthetics along streams, waterways, wooded areas and other greenways to benefit local neighborhoods.
11. Promote sustainability and low-impact development initiatives.

1.7 Engineering Design Accountability

The Design and Specifications Manual contains information to assist in the design and layout of most projects. However, this manual does not replace or otherwise excuse the need for professional engineering judgment and knowledge. The user of this manual is hereby cautioned that many aspects of engineering design must be considered, including but not limited to:

- Public health and safety
- Site-specific conditions or unusual features of a project site that warrant special designs
- Current versions of design texts, manuals, technical documents and research

Depending on the size and scope of the project, the plan documents must be sealed by a design professional, e.g. professional engineer, registered in the state of South Carolina. Please refer to the Stormwater Ordinance for specific requirements. Plan documents include site plans, applicable details, calculations, construction specifications and other necessary technical documents. In all cases, the design professional must have sufficient education and experience to perform a complete design of each element shown on the construction plans, and he must also have complete control to change the plans during the design phase. The professional's



stamp is a public guarantee that his design has the highest regard for health and safety, protects the environment (air, soil, water) to the maximum degree possible, and serves the interests of the general public.

The City of Greenville requires design expertise in stormwater calculations and flooding analyses. Stormwater design criteria are based upon current scientific knowledge and engineering judgment. It should be realized that flooding may occur at any time due to any number of factors beyond the reasonable control of the City, such as greater amounts of precipitation or different rainfall patterns than used in design storms, wet soil conditions, debris or blockage of key stormwater channels, high groundwater tables, etc. However, the engineer is not excused from performing a thorough upstream and downstream analysis in the design of stormwater elements to eliminate flooding issues to the greatest extent practical.

For all development plan components, the design professional bears the ultimate accountability for proper, complete, and responsible design. Review and acceptance by the City of Greenville does not relieve the design professional from his obligation to protect the general welfare or his liability to meet all applicable regulatory requirements.

I.8 Future Changes and Revisions

These standards may be periodically updated as necessary to provide additional clarity or to reflect changes generally recognized as best practice in the appropriate professional and trade industries. The Office of the City Engineer will be responsible for amendments and revisions. Revisions may be made by an act of the Administrator except to regulations and legal provisions adopted by an act of law.

Technical revisions and corrections to these standards shall be made as necessary in accordance with good engineering standards and practice. Technical revisions require the approval of the Administrator. If technical revisions are deemed necessary, the revisions may occur through either planned periodic revision or an accelerated process when it is determined that an immediate revision is necessary.

I.9 Language and Interpretation of Text

The following language rules are applicable to the Design and Specifications Manual:

- I. The imperative case is always mandatory. The words “shall” and “must” are always mandatory. These actions must be performed unless sufficient engineering justification is submitted to city officials within the Engineering Division and written approval has been specifically granted.



2. The words “should” and “recommend” indicate an action that is highly recommended under most conditions. The words “may” and “suggest” indicate an allowable action or choice that is usually beneficial in meeting the minimum city requirements.
3. Use of the singular or plural case of a noun will not affect the applicability of this manual, or any other law, regulation, or ordinance, unless the context of the sentence specifically indicates that the singular/plural case affects the intended use or function on a scientific or engineering basis. The use of a singular or plural noun does not necessarily indicate whether to design or construct a single unit or multiple units.
4. The Administrator of the Design and Specifications Manual is the Engineering Services Manager.
5. Any reference to the City Engineer shall also mean the duly authorized representatives, bureaus or employees under his supervision who have the delegated responsibility. Areas of delegated responsibility may include, but are not limited to, review and approval of plans, review and approval of survey plats, definition of standards or requirements, approval of special conditions, review and issuance of permits, inspections and field investigations, enforcement actions, issuing notices of violation, conduct of public meetings, etc.
6. Within the Design and Specifications Manual, the term “Greenville” or “City of Greenville” shall refer to an official of the Engineering Division with the appropriate responsibility and authority for the particular action or judgment.
7. The term “development” shall generally include changes or improvements to any property that has already been developed previously. In other words, this manual also applies to redevelopment, replacement, structural additions, paving, regrading, etc. Please refer to the applicable ordinance(s) as adopted for definitions of the term “redevelopment.”
8. The terms "property", "lot", "parcel" and "plot" are generally used interchangeably to refer to a single undivided portion of land that is either legally recorded in the Greenville County property records, or is being proposed in good faith by well-prepared plan drawings for the purpose of being legally recorded. In each instance, it is the responsibility of the property owner (or his agent) to see that property is legally recorded at the Greenville County Register of Deeds.
9. The terms "building" and "structure" are used interchangeably throughout the Design and Specifications Manual, even though there may be differences in the definitions listed in the adopted ordinance(s).

In general, all words in the Design and Specifications Manual shall have the common dictionary meanings and definitions. Common abbreviations and acronyms are defined within the Design and Specifications Manual. In some instances, the abbreviation or acronym is only introduced once if in common usage; in other cases, the abbreviation or acronym is spelled out each time it is used.



chapter 2

PLAN REVIEW PROCESS

Note: This chapter is under construction. This chapter will provide an overview of the plan review process from the Engineering Division perspective. The different Bureaus and their responsibilities will be discussed. Permit Engineering Review and Tracking System (PERTS) will be introduced and the review timeline metric will be discussed relative to the overall site permit process. In addition, the plan review processes for delegated sanitary sewer plans as well as peripheral development elements like retaining walls and lighting plans will be discussed.

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chapter 3

AVAILABLE RESOURCES

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chapter 4

PROPERTY REGULATIONS

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chapter 5

PERMITTING RESPONSIBILITIES

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chapter 6

GENERAL DEVELOPMENT REQUIREMENTS

Note: This chapter is under construction. This chapter will discuss general submittal requirements for most developments. Included will be a discussion of the role of the pre-approved details and notes included in the appendix of this manual. This chapter will discuss the sidewalk and curb lawn directive for new and redevelopment projects and the variance process. There will also be a discussion of the pre-design conference, the typical submittal set, the importance and thresholds for traffic impact studies, required maintenance agreements, work zone traffic control plans, a brief description of typical inspections through the construction process and for project closeout, warranty requirements, surety bond requirements, and as-built drawing requirements.

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chapter 7

STREET DESIGN CRITERIA

7.1 Overall Design Guidelines

The minimum design standards for streets and roads in the City of Greenville are presented in this chapter. Design details are included in Appendix A. In all cases not covered under these criteria, AASHTO, "A Policy on Geometric Design of Highways & Streets" latest edition shall rule.



Design Criteria ^{1,2}	Alley ^{8,9}	Local Low Volume Residential	Local Residential	Local Residential with On-Street Parking	Collector ¹⁰		Arterial ¹⁰
Estimated Daily Volume ³	≤ 300	≤ 300	301-1,500	301-1,500	1,501 - 8,000		> 8001
Right of way width	25'	41'	55'	61'	varies ¹¹		varies ¹¹
Street pavement width (F/C to F/C)	20'	20'	28'	34'	varies ¹¹		varies ¹¹
Minimum Traffic Lane Width	10'	10'	14'	17'	varies ¹¹		varies ¹¹
Minimum Centerline Grade	0.5%	0.5%	0.5%	0.5%	0.5%		0.5%
Maximum Centerline Grade ⁴	15%	15%	15%	15%	10%		7%
Minimum Design Speed (mph)	15	25	25	25	30	40	45
Minimum Centerline Radius	50'	200'	200'	200'	337'	773'	1055'
Minimum Tangent Length between Horizontal Curves	--	100'	100'	100'	100'	150'	200'
Minimum Stopping Sight Distance	80'	155'	155'	155'	200'	305'	360'
K-value Crest ⁵	3	12	12	12	19	44	61
K-value Sag ⁵	10	26	26	26	37	64	79
Maximum Algebraic Difference in Centerline Grades without Vertical Curve	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	0.5%
Minimum Desired Spacing of Breaks in Centerline Grade	100'	300'	300'	300'	300'	350'	400'
Minimum Face of Curb Radius for Radius Returns	15'	20'	20'	20'	25'	30'	30'
Minimum Sight Triangles at Street Intersection	20'	25'	25'	25'	25'	30'	40'
Minimum Intersecting Angle of Centerlines at Intersections	80°	80°	80°	80°	80°	80°	80°
Minimum Block Length	250'	250'	250'	250'	250'	600'	600'
Maximum Block Length	1,800'	1,800'	1,800'	1,800'	1,800'	1,800'	1,800'
Minimum Centerline Offset Jogs	--	125'	125'	125'	200'	200'	300'
Maximum Leveling Grade at Intersections (along centerline) ⁶	3.0%	3.0%	3.0%	3.0%	5.0%	5.0%	5.0%
Minimum Leveling Grade Distance from Intersecting of Travelway	50'	50'	50'	50'	75'	75'	75'
Minimum Block Length to Cul-de-sac ⁷	--	--	150'	150'	--	--	--
Maximum Block Length to Cul-de-sac ⁷	--	--	800'	800'	--	--	--
Minimum Right of Way Radius of Cul-de-sac ⁷	--	--	50'	50'	--	--	--
Minimum Pavement Radius F/C to F/C of Cul-de-sac ⁷	--	--	42'	42'	--	--	--



1. In all cases not covered under these criteria, AASHTO, "A Policy on Geometric Design of Highways & Streets" latest edition shall rule.
2. Refer to typical section for utility easement, sidewalk and curb lawn widths.
3. Refer to typical section for additional use criteria.
4. On-street parking is not recommended on grades steeper than 10%.
5. In both crest and sag conditions, minimum length of vertical curves shall be three (3) times the design speed.
6. Per ADAAG, the cross slope of marked pedestrian cross walks at stop conditions shall be a maximum of 2%.
7. Cul-de-sac permitted with Local Residential and Local Residential with On-Street Parking sections. Maximum estimated daily volume is 400 ADT. Block length measured from the edge of intersecting travel way to the center of the turnaround. Refer to cul-de-sac detail for additional right-of-way and design criteria.
8. One-way alley design on a case-by-case basis. Geometry follows that of angled parking. Right-of-way width is typically 5' plus the pavement width.
9. Curb and gutter is omitted from alley section.
10. While a pre-design conference is recommended for all street design, a pre-design conference is required for the design of residential & commercial collectors and arterials. Final determination of appropriate design speed by the City Engineer.
11. Refer to typical section details for cross section zones and design element minimums.



Note: Remainder of chapter is under construction. The full development of this chapter will provide a review of the overall design guidelines for street development and redevelopment within the City. Street classification will be discussed as will the general design elements (e.g. design speed, traffic and use considerations, vertical and horizontal alignment, sight distance, intersection design, pavement sections) for all streets within the City. Utility provider coordination and the process for accepting streets into the public network will also be discussed. Additionally, traffic calming, street naming, striping and signage, and lighting will be discussed. Finally, private street development requirements will be discussed.



chapter 8

WASTEWATER UTILITY

8.1 General Requirements

The following *Wastewater Utility* regulations shall be followed for the design and construction of all sanitary sewer facilities installed in the City of Greenville. The requirements specified hereinafter are considered to be minimum requirements. Additional requirements set forth in the Land Management Ordinance apply, including but not limited to Section 6-4, *Plumbing Code*; 19-6, *Site Development and Related Infrastructure*; and 19-7, *Stormwater Management*.

Design of all wastewater facilities that are to be dedicated to the City shall be performed by a Professional Engineer registered in the State of South Carolina. All designs shall be in accordance with, in order of precedence, the City of Greenville Land Management Ordinance (LMO) and the Design and Specifications Manual, South Carolina Department of Health and Environmental Control (SCDHEC) Regulation 61-67, and the Ten State Recommended Standards for Wastewater Facilities (latest edition). Where this article and other ordinance, deed, or plat restrictions conflict or overlap, whichever imposes the more stringent restrictions shall prevail.

Horizontal survey datum control shall be based upon, and referenced to, South Carolina State Plane, NAD83 HARN, International Feet coordinates. Vertical survey datum control shall be based upon, and referenced to, the North American Vertical Datum of 1988 (NAVD 88). Electronic drawings submitted to the City shall be in the correct projection, coordinate system, datum, and units.

Sanitary sewers are designed for the collection and transmission of wastewater. Downspouts; foundation drains; yard drains; area drains; basement drains; residential, industrial and commercial cooling water; hazardous waste materials; and sump discharges for other than sanitary wastes shall not be connected to the facilities of the City nor into any sewer leading into any facilities of the City. Other connections may be approved on a case-by-case basis.

The safety and protection of public and private water supplies is paramount. There shall be no connection between any public or private potable water supply system and any sewer or appurtenance thereto which would permit the passage of any sewage or polluted water into the potable water supply.



8.2 Gravity Sewers

System Sizing No new wastewater mains shall be less than eight inches in diameter. Average daily flows shall be calculated using SCDHEC's Unit Contributory Loadings and/or known discharges established through flow monitoring. Peak flows shall be calculated by multiplying the average daily flow by a peaking factor based on the following formula. In no case shall the peaking factor be less than 2.5.

$$\text{Peak Factor} = \frac{18 + \sqrt{P}}{4 + \sqrt{P}} \quad \text{where } P = \text{population in thousands}$$

Refer to "Recommended Standards for Wastewater Facilities," latest edition

Design peak flows in sewers less than 12 inches in diameter shall be limited to approximately $d/D = 0.5$, and sewers 12 inches and larger shall be limited to approximately $d/D = 0.7$, where d is the flow depth, and D is the pipe diameter.

Utility Enlargement and Extension Sewer mains shall be designed to serve the entire drainage basin. Flow calculations shall include projections of future flows for upstream areas that drain into the site based on zoning and current development trends. Larger size utility facilities than are required to accommodate the needs of the proposed development may be required by the City in accordance with the requirements of Section 19-6.7.3 (F) of the LMO or as amended.

Similarly, provisions shall be made for logical future extensions at proposed or existing street connections and at other locations as determined by the City Engineer in accordance with the requirements of Section 19-6.7.3 (E) of the LMO or as amended. In the case where no upstream extensions are reasonable or likely, wastewater systems may be terminated at a point acceptable to the City Engineer. Future extensions may be accomplished via an additional manhole and/or section of pipe as directed by the City Engineer. The pipe shall be properly sealed to prevent infiltration into the sewer system. Additionally, the manhole and pipe shall be pressure tested in accordance with City specifications along with the remainder of the sewer system.

Minimum Velocity and Slope Gravity sewers shall be laid with uniform slope between manholes.

Computations of full-flow velocity shall be based on Manning's formula using an "n" value of 0.013. In cul-de-sacs or other low flow situations where it has been determined by the City that future extension is not likely or feasible, the slope from the starter manhole shall be a minimum of 1 foot per 100 feet. For all other cases, the minimum slope of a wastewater main shall be 0.5 feet per 100 feet or as otherwise directed by the City Engineer during preliminary design.



Decreased slopes will be considered only when there are significant adverse conditions as determined by the City Engineer. In such cases, installations with slopes less than 0.5 feet per 100 feet shall have a design average flow depth of at least 0.3 of the diameter or greater ($d/D \geq 0.3$) and maintain a minimum velocity of 2.0 feet per second. In no case shall the slope of a pipe fall below the minimum values listed in Table 8.1 below. Pipe sizes shall not be increased arbitrarily to take advantage of a flatter grade.

TABLE 8.1

Sewer Diameter (inches)	Minimum Slope (feet per 100 feet)
8	0.40
10	0.28
12	0.22
14	0.17
15	0.15

Maximum Velocity Average flow velocities greater than fifteen feet per second will not be permitted without special exception. Drop manholes shall be provided where required to reduce steep slopes and high velocities. Where permitted velocities are anticipated to exceed fifteen feet per second, restrained joint pipe and fittings may be required and the pipe material and/or special linings shall provide protection against internal erosion in conformance with ASTM and/or American Water Works Association (AWWA) specifications.

Sewers on twenty percent slopes (20 feet per 100 feet) or greater shall be anchored securely with concrete anchors or approved equal. Anchors shall be spaced as listed in Table 8.2.

TABLE 8.2

Slope (percent)	Maximum Spacing (feet, center to center)
20 to 34.9	36
35 to 49.9	24
50 and up	16

Alignment Gravity sewers shall be laid with straight alignment between manholes. Where applicable, lines shall be laid beneath the travel way, with manholes centered within a lane. Installations under curb lines shall be limited to the greatest extent possible. Sewer lines shall be constructed such that the internal angle of deflection is equal to or greater than ninety (90) degrees.



Depth For most common applications, the minimum bury depth from the top of the pipe to the surface shall be 4.0 feet and the maximum bury depth shall be 20.0 feet. The presence of rock or unsuitable soil conditions is not necessarily justification for reduced cover. Reduced cover and installations deeper than 20 feet may be approved on a case-by-case basis by the City Engineer. Burial depths less than 3.0 feet will not be permitted.

Pipe Material Pipe material shall be the same between manholes. Material transitions necessary as part of a point repair, connection to an existing system, or other special conditions require prior approval by the City Engineer. The transition must be a rigid type coupling designed specifically for transitioning between the two types of materials in conformance with ASTM C1173, D5926, and ASTM A240/A240M such as 5000 Series Strong Back RC Couplings by Fernco®, or approved equal. Flexible couplings and adapters are not permitted.

For most common applications, sewer pipe shall be SDR 26 or SDR 35 Poly Vinyl Chloride (PVC) pipe meeting ASTM D3034 for 4" to 15" diameter pipe or ASTM F679 for 18" to 36" diameter pipe. Pipe shall be made from PVC compounds having a cell classification of 12454B as defined in ASTM D1784. Pipe shall incorporate an integral bell joint with a single rubber gasket conforming to ASTM F477. Joints shall be in accordance with ASTM D3212, and be furnished complete with all necessary accessories. All fittings and accessories shall be furnished with either Push-on or Mechanical Type Joints and shall be compatible with the pipe to which they are attached. All fittings and accessories shall meet the specifications defined in ASTM D3034 and ASTM F1336. Pipe shall be legibly and permanently marked with the following minimum information:

- Manufacturer's name or trademark and production code
- Nominal size
- PVC cell classification
- "SDR-26 PVC Sewer Pipe" or "SDR-35 PVC Sewer Pipe" as appropriate
- "ASTM D 3034"

Alternatively, asphalt coated cement mortar lined Class 50 Ductile Iron Pipe (DIP) may be placed. DIP shall be pressure class 150. DIP shall be designed and manufactured in accordance with ANSI/AWWA C150/A21.50 and C151/A21.51. Pipe shall have a standard 1-mil asphaltic coating applied on the exterior of the pipe in accordance with ANSI/AWWA C151/A21.51. Pipe shall also have a cement-mortar lining on the interior in accordance with ANSI/AWWA C104/A21.4. All pipe shall be furnished with Push-on Type Joints, such as Tyton® or Fastite®. Joints shall be in accordance with ANSI/AWWA C111/A21.11, and be furnished complete with all necessary accessories. Fittings shall be ductile iron conforming to the latest revision of either ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53. Fittings and accessories shall be furnished with either Push-on or Mechanical Type Joints in accordance with



ANSI/AWWA C111/A21.11. Pipe shall be legibly and permanently marked with the following minimum information:

- Class or nominal thickness
- Net weight without lining
- Casting period
- Manufacturer's name or trademark
- Country where cast
- Production year
- "DI" or "Ductile"

When burial depths are less than 4.0 feet or greater than 20.0 feet, DIP shall be used.

When soil tests in accordance with Appendix A of ANSI/AWWA C105/A21.5 and/or performance history indicate that conditions are corrosive to DIP, positive corrosion protection is required. In most cases, polyethylene encasement, in accordance with the AWWA C105 standard, shall be applied for corrosion protection. It shall be the burden of the owner/developer to satisfy the City as to the extent and aggressiveness of corrosive soils.

When DIP is used to transport septic sewage, where hydrogen sulfides create a corrosion-related problem, specially lined pipe is required. The lining shall cover, at a minimum, the inner surfaces of the pipe and the fitting from the plain end or beveled spigot end to the rear of the gasket socket. If flanged fittings and pipe are included in the project, the lining must not be used on the face of the flange; however, full face gaskets must be used to protect the ends of the pipe. The interior of the pipe shall have a protective lining with an average dry film thickness of 40 mils and a minimum thickness of 35 mils. Protective lining shall be installed per the manufacturer's specification. Due to the tolerances involved, the gasket area and spigot end up to 4 inches back from the end of the spigot end must be coated with a nominal 10 mil, 6 mil minimum, thickness. The quality of the lining and adherence to installation specifications must be certified prior to acceptance. Novocoat SP2000®, Protecto 401® are approved coatings for DIP. The specially lined pipe shall be placed from the source of the septic sewage downstream to a point acceptable to the City Engineer.

Installation PVC pipe shall be installed in conformance with the latest City standard details and specifications and in accordance with ASTM D2321. Ductile iron pipe shall be installed in conformance with the latest City standard details and specifications and in accordance with sections 4.3.1 through 4.3.5 (except 4.3.3.5, 4.3.4.4, and 4.3.5.1.1), 5.1.1, and 6.1 of ANSI/AWWA C600 as well as the applicable portions ASTM D2321 for non-rigid pipe installation. Each section of sewer pipe shall be laid to the appropriate line and grade, as designed and permitted, working in the upstream direction with the bell end laid upgrade.



Horizontal and Vertical Separation All separation requirements are measured from the nearest outside edge of the sewer pipe to the nearest outside edge of that which is being avoided. A minimum of 18 inches clearance, both horizontally and vertically, shall be maintained between wastewater systems and all other underground systems. No utility shall be installed within 4 feet of a wastewater manhole.

Additionally, sewers shall be laid at least ten feet horizontally from potable water mains, unless otherwise permitted by the City Engineer. Should local conditions prevent a horizontal separation of ten feet, the sewer main must be laid in a separate trench where the elevation of the top of the sewer is at least 18 inches below the bottom of the water main. Where it is impossible to obtain proper horizontal and vertical separation as described, the sewer main shall be constructed of slip type or mechanical joint pipe complying with ANSI/AWWA C900 or ANSI/AWWA C600, public water supply standards, and be pressure tested in place to 150 psi to assure water tightness prior to backfilling. This section of the sewer line shall also be pressure tested in accordance with City specifications along with the remainder of the sewer system.

Prior approval from the City Engineer must be obtained before a wastewater main is permitted to cross a water main. When local conditions necessitate that a sewer main and potable water main cross, all reasonable effort must be made for the sewer line to cross under the water main. Sewers crossing water mains shall be laid to provide a minimum vertical separation of 18 inches. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints.

When unique and exceptional conditions exist such that a minimum 18 inch vertical clearance cannot be maintained between a wastewater main and any other underground utility crossing, the following conditions must be met:

1. The crossing shall have adequate structural support to prevent damage to the main.
2. The sewer main shall be constructed of slip type or mechanical joint pipe complying with ANSI/AWWA C900 or ANSI/AWWA C600, public water supply standards, and be pressure tested in place to 150 psi to assure water tightness prior to backfilling. This section of the sewer line shall also be pressure tested in accordance with City specifications along with the remainder of the sewer system.

When a new utility installation crosses an existing sewer line not meeting the minimum clearances specified above, a section of the existing sewer line must be replaced with pipe meeting conditions 1 and 2 above for a distance of at least 10 feet on each side of the crossing utility, or as directed by the City Engineer. In addition to the requirements specified above, a water main shall not be allowed to pass through or come into contact with a sewer manhole.



Relationship to Water Bodies Sanitary sewer lines shall not be located under ponds, lakes, storm water detention ponds, or within dams or any other structures that hold water on a permanent or temporary basis. Sewers crossings must meet all associated state and federal permitting requirements. Aerial and underground stream crossings will be approved by the City Engineer on a case-by-case basis. Sewer systems shall be designed to minimize the number of stream crossings. Sewers crossing streams must be designed to have a minimum impact on the stream cross section and ecosystem and must cross the stream as nearly perpendicular to the stream flow as possible. Crossings of navigable streams may require the installation of advance warning signage at the direction of the City Engineer.

If an aerial crossing is necessary, support shall be provided for all pipe joints. The supports shall be designed to prevent frost heave, overturning, and settlement. Precautions against freezing, such as insulation and increased slope, shall be provided. Expansion jointing shall be provided between above ground and below ground sewers. Where buried sewers change to aerial sewers, special construction techniques shall be used to minimize frost heaving. The bottom of the pipe shall be placed no lower than the elevation of the 50 year flood. The impact of flood waters and debris shall be considered. Ductile iron pipe with mechanical joints is required and must extend between the closest upstream and downstream manhole. Piers and all appurtenances thereto require structural analysis of horizontal and vertical stability by a South Carolina Professional Engineer. All reasonable effort shall be made to the satisfaction of the City Engineer to minimize the number of piers located within the floodway. Alternative measures, such as a steel casing and carrier pipe system, may be used to clear longer spans and reduce the number of piers necessary to support the pipe.

If an underground stream crossing is necessary, it shall be installed via the jack and bore method, and the encasement and carrier pipe shall be installed in conformance with the latest City standard details and specifications. The encasement pipe shall extend a minimum of 20 feet on both sides of the stream channel measured from the top of bank, or as directed by the City Engineer. The top of all encasement pipes shall be at a sufficient depth below the natural bottom of the stream bed to protect the sewer line crossing. In general, the following cover requirements must be met:

- One foot of cover where the sewer is located in rock.
- Three feet of cover in other material. In major streams, more than three feet of cover may be required.
- In paved stream channels, the top of the sewer line shall be placed one foot below the bottom of the channel pavement.

Steel Pipe Casing When dry boring and jacking is required for the construction of wastewater lines or a steel casing and carrier pipe system is used for longer aerial spans, installation shall be in conformance with the latest City standard details and specifications. Steel casing pipe shall be manufactured in accordance with ANSI A53. The steel pipe shall be Type S,



Grade B, plain and beveled. Steel pipe shall have a minimum yield strength of 35,000 psi. All steel casing pipe shall be furnished in 20-foot lengths and all joints welded in accordance with AWWA C206. Steel casing pipe shall be laid to the appropriate line and grade, as designed and permitted, working in the upstream direction. Steel casing for long span aerial pipe crossings shall have the minimum wall thickness for the anticipated clear span as shown in latest City standard detail. For underground installation by dry boring and jacking, the minimum wall thickness shall be as shown in Table 8.3 below.

TABLE 8.3

Nominal Diameter (inches)	Nominal Thickness (inches)
Under 14	0.188
14, 16	0.219
18	0.250
20	0.281
22	0.312
24	0.344
26	0.375
28, 30	0.406
32	0.469
38, 40, 42	0.500

When the casing pipe is installed without the benefit of protective coating or said casing is not cathodically protected, the wall thickness shall normally be increased to the next higher standard thickness as approved by the City Engineer.

8.3 Manholes

General New manholes shall be precast 4000 psi reinforced concrete, in conformance with the latest City standard details and specifications and in accordance with ASTM C478. Cones shall be of the eccentric type. When watertightness is not a primary concern, joints in riser sections shall be set with a butyl joint material complying with ASTM C990 and grouted inside and out with non-shrinking grout in conformance with ASTM C1107, C827, and CRD C621 such as 1107 Advantage Grout™ by Dayton Superior, or approved equal. No more than two lift holes may be cast or cored in each section. Lift holes shall be plugged with a rubber plug and grouted inside and out with non-shrinking grout in conformance with the standards above. Steps, in conformance with the latest City standard details and specifications, shall be provided for all manholes greater than four feet of depth measured from the top of the cover to the lowest invert of the flow channel. No more than three tributary inlets are permitted to connect to any one manhole without prior approval of the City Engineer. Installations of



doghouse type manholes are not permitted without prior approval of the City Engineer. Where a new sewer line ties to an existing brick manhole, the manhole must be completely replaced with a precast reinforced concrete manhole meeting City specifications.

Location Manholes must be installed at the end of each gravity sewer main line; at all changes in line size, slope, or alignment; and at all intersections. Additionally, manholes must be installed at intervals not greater than 300 feet for all sewers 24 inches and smaller. Where applicable, manholes shall be placed within the center of the travel lane.

Diameter For most common applications, the minimum interior diameter of gravity sewer manholes shall be 48 inches for manholes that are 12.0 feet deep or less and 60 inches for manholes deeper than 12.0 feet, measured from the lowest invert of the manhole to the top of the cover. For large pipe installations, larger diameter manholes may be required. In such case, the minimum interior diameter of the manhole shall be no less than the interior diameter of the largest sewer entering the manhole, plus 18 inches. Manholes shall be structurally designed by a South Carolina Professional Engineer when interior diameters exceed 60 inches or depths exceed 20 feet; additional special provisions may be required as determined by the City Engineer.

Flow Channel The flow channel straight through a manhole shall conform as closely as possible in shape to that of the connecting sewers and be a smooth connection between the inlet tributary and the outlet pipe. Flow channels between an inlet tributary pipe and the outlet pipe may be field constructed or precast. The invert of the pipe shall be equal to the invert of the flow channel at the connection. The channel walls shall be formed or shaped to the full height of the crown of the outlet sewer in such a manner to not obstruct maintenance, inspection or flow in the sewers and to prevent solids deposition. When curved flow channels are specified in manholes, increased channel slope may be necessary to maintain acceptable velocities. The maximum difference in elevation between the invert of the tributary inlet and the manhole invert shall be 18 inches. Elevation differences greater than 18 inches require a drop manhole.

Drop Manholes The use of drop manholes shall be minimized. The City Engineer shall approve the use of drop manholes only when it cannot be avoided. The minimum drop, measured from the invert of the incoming pipe to the manhole invert, shall be no less than 3 feet. No connection to the manhole shall be made between 18 inches and 3 feet above the manhole invert.

Drop manholes must be constructed with an outside drop connection in conformance with the latest City standard details and specifications. Interior drop manholes are not permitted without special exception by the City Engineer.



Bench A bench shall be provided on each side of any manhole channel when the pipe diameter(s) are less than the manhole diameter. The bench must be sloped no less than ½ inch per foot. No tributary inlet, including service connections, nor drop manhole pipes shall discharge onto the surface of the bench.

Head Loss in Manholes Through design and installation, careful consideration must be taken to compensate for the head losses occurring through the flow channel between all manhole inlets and outlets. Manholes shall have a minimum 0.1 foot drop in elevation from the lowest tributary inlet invert to the invert of the outlet. Where a new sewer connects to an existing main and a new manhole is required, there shall be a minimum 0.3 foot drop in elevation from the invert of the new inlet tributary to the outlet pipe invert. All changes of direction, size or shape of sewers shall be made by gradual transitions so as to minimize head loss in manholes. Where a smaller sewer transitions to a larger one through a manhole, the same energy gradient must be maintained. An approximate method for securing these results is to match the 80 percent depth point of both sewers. The City may require calculations supporting the design of the transition through the manhole.

Boot Connections All pipe connections into existing precast manholes shall be installed by coring and utilize a flexible boot such as Kor-N-Seal® or approved equal. The flexible boot shall be in conformance with the latest City standard details and specifications and in accordance with ASTM C923, ASTM A666, and ASTM A240. The installed pipe shall have a smooth, formed invert; boring or chipping of the existing table to the flow channel is required. Corings for boot connectors shall not be made within six inches of a manhole barrel section joint. Other than precast concrete manholes and without the written approval of the City Engineer, existing manholes may not be cored. The existing manhole must be replaced and new connections installed. Re-coring or over coring an existing connection may not be accepted by the City and should be avoided.

Frames and Covers Frames and covers conforming to the latest version of the published City standard details shall be used on all publically owned wastewater mains. All frames and covers shall be certified for H-20 loading. Manhole frames and covers shall be set at elevations to exclude surface water. Within the travel lane, manhole frames and covers shall be set at grade to match the final paved surface. Without special exception by the City Engineer, the rim elevation shall be set 18 inches above the existing ground elevation and shall have a 5H:1V approach grade around the manhole when located outside of the public right-of-way.

Adjustment rings may be used to adjust manhole rim elevations up to 12 inches above the top of the eccentric cone section. Adjustments greater than twelve inches require additional barrel riser sections installed below the cone section.

Locked manhole covers may be required in isolated easement locations or where vandalism may be a problem.



Watertightness Infiltration to and exfiltration from the sanitary sewer system must be minimized to the greatest extent possible. Watertight manhole covers are to be used wherever the manhole tops may be flooded by street runoff or high water. All manholes and other above ground access points located below the Flood Protection Elevation (FPE) shall be watertight. Watertight manholes shall conform to the latest version of the published City standard details. Where a series of watertight manhole covers are used on a wastewater main for a distance of 1,000 feet or more, vent pipes conforming to the latest version of the published City standard details are required. Elevated manholes shall be a Revolution Access Assembly by East Jordan Iron Works, or approved equal.

Within the floodplain, in areas with a high water table, or in other areas as directed by the City Engineer, manhole joints shall be sealed with O-ring gaskets in conformance with ASTM C443 and non-shrinking grout in conformance with ASTM C1107, C827, and CRD C621 such as 1107 Advantage Grout™ by Dayton Superior, or approved equal. Additionally, the manhole shall receive water proofing by one of the following methods:

1. The exterior of the manhole shall receive a 40 mil coating of bituminous coal tar epoxy coating meeting the requirements of AWWA C210. Prior to application, all surfaces must be clean and structurally sound, free of dirt, grease, oil, paint, etc. Remove contamination with abrasive blasting, water blasting or wire brush. Make sure all dust is removed after abrasives. Concrete shall be blasted or acid etched before coating. Remove all acid with water before coating. Coating shall be applied in accordance with the manufacturer's specifications.
2. Manholes shall be sealed using waterproofing admixture IPANEX® by IPA Systems in accordance with the manufacturer's dosage and mixing instructions. The admixture shall be dosed at a rate of 13.8 fluid ounces per 100 weight of cementitious per cubic yard of concrete, and all IPANEX® modified concrete shall be batched, delivered, and discharged in accordance with ASTM C94. Certification of the precast units shall be provided prior to acceptance.

Corrosion Protection for Manholes Where corrosive conditions due to septicity or other causes are anticipated, like at a force main discharge, corrosion protection on the interior of the manholes shall be provided. In such case, the interior of the manhole shall receive a 10 mil minimum thickness acid resistant coating material such as Novocoat SP2000® or approved equal. The interior of manholes for a distance not less than 1,000 linear feet downstream of the corrosive source must also be coated with the acid resistant material.

8.4 Pump Stations and Force Mains

The owner/developer and engineer must coordinate a pre-design conference for all projects requiring the use of pump stations and force mains. All pump stations and force mains are



subject to review and inspection by the City Engineer. Pump stations may be subject to special provisions based on local conditions as directed by the City Engineer. Pump stations shall only be permitted when the City determines that one is necessary for the orderly development of the City in a manner consistent with the protection of the public's interest. Pump stations should typically be regional in nature. Pump stations and force mains shall be designed and installed in accordance with sound engineering practice and must adhere to South Carolina Department of Health and Environmental Control Regulation 61-67, Ten State Recommended Standards for Wastewater Facilities (latest edition), and Renewable Water Resources (ReWa) regulations. Third party peer review and inspection may be required, and the standard review fee may be modified to include the incurred costs of said review.

8.5 Easements

The City of Greenville implemented a Rights-of-Way and Easements Policy as part of a 2003 Environmental Protection Agency (EPA) Consent Agreement and Consent Order. The policy's focus is maintaining accessibility to City of Greenville wastewater infrastructure for inspection, maintenance and repair. Accessibility is achieved through the establishment of restricted utility easements that maintain a Clear Zone above and around City of Greenville wastewater infrastructure. The information below presents the intent of the policy relative to wastewater infrastructure installations. The full policy is located in Appendix E.

A permanent easement with an established Clear Zone, centered over the installed underground system, shall be conveyed to the City. Generally, the easement width must be 25-feet for sewer mains 36" in diameter and smaller. Larger easements may be required by the City Engineer at his discretion. Generally, justification for a larger easement includes, but is not limited to, remote locations, adverse slopes, and/or poor site conditions. When unique and exceptional conditions prohibit the conveyance of a full easement width, the City Engineer may reduce the required width subject to the minimum widths given in Table 8.4 below.

TABLE 8.4

Nominal Pipe Diameter (inches)	Trench Depth			
	4' and less	4' to 7'	7' to 10'	10' and greater
8 to 12	15'	15'	20'	25'
15 to 24	15'	20'	20'	25'
27 to 36	20'	20'	20'	25'



The Clear Zone width shall be the entire width of the easement. The City Engineer may increase or reduce the width of the required Clear Zone. However, the minimum Clear Zone should never be less than fifteen feet (15') in width, centered over the underground system.

The entire width of the easement Clear Zone shall remain clear and fully accessible, and access to manholes shall be preserved at all times. No obstacles that inhibit the City's ability to access and maintain its infrastructure shall be placed within an easement Clear Zone including, but not limited to, temporary or permanent structures, walls, fences, trees, ponds, lakes, storm water detention ponds, dams, or any other structures that hold water on a permanent or temporary basis. The City of Greenville has the right to cause any obstruction to be removed without notice to the property owner and all related costs shall be the property owner's responsibility. The City will not bear the responsibility for property loss or damage for unpermitted items placed within the easement Clear Zone. Asphalt paths, concrete sidewalks, roads, parking lots, grass, shrubs and other planting whose natural height does not exceed three feet are permitted in the easement Clear Zone. Maintenance for these items is the responsibility of the property owner or homeowners association; however, like all other items not defined for use in the easement, they are at risk and subject to removal at any time.

In order to meet the Clear Zone requirements, the following hierarchy is established:

1. Wastewater infrastructure installations shall be located within public rights-of-way or within permanent easements adjacent to public rights-of-way. Where wastewater infrastructure is placed within an existing easement or right-of-way, but there is less than half of the full width of the required easement or right-of-way on each side of the underground system, additional easement or right-of-way may be required by the City to provide the full easement width.
2. Wastewater infrastructure installations shall be located within a permanent easement through areas with unrestricted paved access, e.g. parking lots or paved access ways.
3. When unique and exceptional conditions exist that prohibit installation in conformance with the above requirements, the City Engineer may permit the installation of wastewater infrastructure within a permanent easement through private property that meets the established Clear Zone requirements to the greatest extent possible. These easements must be clearly marked and identifiable and generally run along common property lines.

Moreover, temporary construction easements, of varying widths, shall be acquired when necessary to facilitate wastewater system construction.

8.6 Service Connections

General Each individually owned parcel and each building having plumbing fixtures installed, whichever is applicable, shall have at least one direct and individual connection to a City wastewater main, otherwise known as a main sewer line. Service connections, otherwise



known as building sewer, are that portion of the wastewater system that extends from the end of the building drain to the connection to the main sewer line. Building sewers shall be constructed in accordance with the standards outlined in the International Plumbing Code (IPC) or the International Residential Code (IRC), as currently adopted. The connection assemblies of the building sewer to the main sewer line shall be installed in conformance with the latest City standard details and specifications. Building sewers must be installed so that the connection does not cross or significantly front another parcel, unless otherwise approved by the City Engineer. Building sewers and their appurtenances are privately owned and maintained from the building drain up to and including the connection to the City main sewer line. The City may require service connections be tested to ensure positive connectivity to the main sewer line prior to placing the building sewer into operation.

Connection to Existing Main Sewer Line All building sewers and their appurtenances must be permitted through and inspected by the City of Greenville Building Codes Division. Prior to connection, the City may require the main sewer line condition be verified for adequacy prior to making a new connection. Additionally, the City may require that adequate capacity of the downstream system to the ReWa trunk line be verified prior to connection.

Connection to New Main Sewer Line In such case as the connection to the main sewer line is part of a new main sewer line installation, the building sewer and associated appurtenances shall be installed and inspected by the City Engineer as part of the main sewer line construction permit with the following conditions:

- The building sewer shall be stubbed out only to the edge of the right-of-way and capped in accordance with the latest City standard details and specifications.
- Without prior knowledge of the variables required to size the lateral per the IPC or IRC, the minimum diameter of the building sewer stub out shall be four (4) inches for single family residential subdivisions and six (6) inches for commercial and multifamily development.
- The building sewer stub out shall be of the same material as the main sewer line.
- When the building sewer is extended from the stub out to the building drain, the building sewer and its appurtenances must be permitted through and inspected by the City of Greenville Building Codes Division.

Connection to a Manhole Service connections may be precast into a new manhole, and shall be made under the direction of the City Engineer. Service connections shall not be made at an existing manhole without written approval and under the direction of the City Engineer. The invert of a service connection at a manhole shall be made at the crown of the main sewer line.

Use of an Existing Service Connections Prior to utilizing an existing service connection, the existing service connection must be tested to ensure that it conforms to City of Greenville performance requirements. The owner/developer may be required to provide the City



Engineer video evidence documenting the condition of the existing service connection prior to permitting its reuse.

Condominium Structures In a vertically arranged condominium structure, one private lateral, owned and maintained by a facility owner, homeowners association, business association, or other entity, may convey wastewater from all condominium units within a single structure to the public wastewater main. The recommended approach for a proposed mixed-use development is to provide a combined sewer service as described above for the residential component and separate individual connections for each privately owned commercial unit within the structure.

Service Connection Exclusions Service connections are limited to the same exclusions as defined by SCDHEC Regulation 61-67 (see also Section 8.9 Definitions). Typically long service connections greater than 6 inches in diameter will be considered main sewer line extensions and are subject to the relative requirements herein.

Grease Traps Grease traps shall be designed and installed as required by the IPC, IRC, and ReWa.

8.7 Permitting Process

Delegated Review Program State law and regulation require submission of plans and specifications and a written permit (Permit to Construct, PTC) before a wastewater system may be constructed or modified. Wastewater systems regulated by the South Carolina Department of Health and Environmental Control (SCDHEC) include main sewer lines, wastewater pretreatment facilities, wastewater treatment facilities, and sludge handling and treatment facilities.

The Environmental Quality Control Regional Offices of SCDHEC and the City of Greenville Construction Inspection Bureau are responsible for the field work associated with the wastewater construction permit program. This includes construction inspections and final inspections to ensure all work is performed according to approved plans and specifications. Before wastewater facilities can be placed into operation, a written authorization to begin operations (Permit to Operate, PTO) must be granted by the Regional Office. Enforcement actions are used by the Bureau when necessary to ensure proper construction permits are obtained and to ensure compliance with these permits.

SCDHEC's domestic wastewater permitting program has been streamlined by offering local public sewer entities, when approved, the option of reviewing the construction permit application package and performing the technical plan review. The Delegated Review Program (DRP) minimizes duplication of technical review and allows for a faster permitting process. The City of Greenville is an approved participant of the DRP for wastewater construction permits.



To obtain a wastewater construction permit, for the purpose of constructing a new segment of wastewater main or relocating or modifying an existing wastewater main, the applicant must submit a complete permit application directly to the Engineering Division of the City of Greenville. The current permit application checklist is located in the Appendix.

Construction Document Requirements Plans and supporting documents must be prepared, signed, and sealed by a licensed South Carolina Professional Engineer. System sizing calculations must include all of the items listed in the current application checklist found in the Appendix. Construction drawings shall, at a minimum, include the proposed wastewater main and manhole locations, rim elevations, invert elevations, drop elevations, pipe slope, pipe material, and proposed service connection locations. The plans must show the proposed wastewater main in both plan and profile views, and both views must show all existing and proposed utility crossings that can be anticipated. Plans must include a vicinity map, graphic scale bar, north arrow, and a note designating the basis of vertical datum. Plans must contain all pertinent notes, details, and standard drawings. Current City of Greenville notes, details, and standard drawings are located in Appendix A of this manual.

Review Process The applicant must submit a complete permit application directly to the Engineering Division of the City of Greenville. Incomplete application packages will be returned to the applicant without review. After a permit application package is reviewed, comments will be returned to the permitting engineer if necessary. The engineer must submit revisions directly to the Engineering Division. Once the City approves the permit application package, the engineer must submit a total of six sets of drawings. The drawing set that is part of the approved application package may be used towards the total number of required sets; the City will notify the engineer of the number of sets of drawings that are outstanding. The approved application package will be sent to SCDHEC in Columbia for review; SCDHEC will issue the Permit to Construct (PTC). The City will contact the engineer, and he (or his representative) must pick up the approved stamped construction drawings from the Engineering Division. The engineer will receive two sets of drawings, one for his records and one for the contractor.

Permit to Construct Requirements Construction is not authorized until the PTC is issued by the City. In accepting the PTC, the owner/developer agrees to the admission of properly authorized persons at all reasonable hours for the purpose of sampling and inspection. A copy of the PTC and one set of approved stamped construction drawings must be kept on site at all times during construction. The City of Greenville Construction Inspection Bureau must be contacted at least 72 hours in advance of a desired start date to schedule a mandatory pre-construction meeting with the City Inspector, contractor and any related sub-contractors, owner/developer, and engineer. The pre-construction meeting must occur prior to beginning any work. Failure to comply will result in a stop work order and may result in State and Municipal penalties. All construction shall be in accordance with the standards and specifications of the City of Greenville. Any modifications to the approved stamped construction drawings must be submitted to the City by the permitting engineer for review and



approval prior to installation of the modification as well as any other affected portion of the system. The PTC does not constitute approval, temporary or otherwise, to place the system into operation.

Permit to Operate Requirements Upon completion of construction and all required testing, the permitting engineer must submit one set of signed and sealed as-built drawings, two letters (both with original signature) certifying the construction is in accordance with the PTC, and one utility easement survey plat for any lines without a full 25-foot wide easement wholly contained within the public right-of-way or an existing public utility easement. The easement plat must meet the minimum standards for a Class A survey in the State of South Carolina and must be signed and sealed by a licensed South Carolina Professional Land Surveyor.

When unique and exceptional conditions exist such that a partial Permit to Operate (PTO) is warranted, the City Engineer, at his discretion, may issue said permit. The partial PTO may be subject to special provisions as directed by the City Engineer. A partial PTO will expire on the date set by the City Engineer at the time the partial PTO is issued but no later than the expiration of the PTC. In most cases, the required warranty period for the system will not commence until the full PTO is issued. In the event that a partial PTO has been issued by the City Engineer, the system must be retested before the full PTO is released.

The as-built drawings shall, at a minimum, include the wastewater main and manhole locations, rim elevations, invert elevations, drop elevations, pipe slope, pipe material for the main and service lateral stub outs, and the distance from the downstream manhole to connection of each service lateral to the main sewer. The plans must show the new wastewater main in both plan and profile views, and both views must show all utility crossings. Plans must display a vicinity map, graphic scale bar, north arrow, and a note designating the basis of vertical datum. Electronic submission of as-built drawings may be required.

After as-built drawings are reviewed, comments will be returned to the engineer if necessary. The engineer must submit revisions directly to the Engineering Division. Once the City approves the submitted as-built drawings, the engineer must then submit three additional sets of signed and sealed drawings (four sets in total).

The utility easement survey plat shall meet the minimum standards for a Class A survey in the State of South Carolina and must be signed and sealed by a licensed South Carolina Professional Land Surveyor. At a minimum the easement plat shall include the wastewater main and manhole locations, including bearing and distance for each line segment, and the extent of the easement, typically 12.5 feet on each side of the centerline of the pipe, and 12.5 feet past the starter manhole. The wastewater line shall be tied to a property corner or other permanent control point. The survey must display the tax map number, graphic scale bar, and north arrow.



After the utility easement plat is reviewed, comments will be returned to the engineer if necessary. The engineer must submit revisions directly to the Engineering Division. Once the City approves the easement plat, the engineer must submit one additional signed and sealed plat (two sets in total). Upon receipt of both survey plats by the Engineering Division, the legal easement document will be prepared and mailed to the engineer for completion by the signatory authority, typically the property owner. The easement document will be accompanied by a Maintenance/Warranty Agreement that must also be completed by the signatory authority. It is in the best interest of the signatory authority to return the completed easement document and Maintenance/Warranty Agreement to the Engineering Division without delay. Upon receipt of the of both executed documents, the City will record the easement with Greenville County RMC office and file the Maintenance/Warranty Agreement with the project. Both executed documents must be returned before the Engineering Division will process the PTO for the wastewater system through SCDHEC.

A complete PTO package includes four signed and sealed as-built drawings, two signed and sealed utility easement plats, an executed Maintenance/Warranty Agreement, two signed engineer's certification letters, wastewater system test results, and a fully executed easement document. Once the Engineering Division has received the complete PTO package, the package will be sent to the Environmental Quality Control Regional Office of SCDHEC for review. Upon approval, SCDHEC will issue the Permit to Operate. Please note that wastewater service connections shall not be connected to a newly constructed wastewater main until a Permit to Operate has been officially issued by SCDHEC and a copy has been received by the City of Greenville Engineering Division.

Warranty Once SCDHEC issues a Permit to Operate for the new wastewater system and the City records all required easements, the Engineering Division will announce the beginning of the mandatory warranty period via a letter to the owner/developer and engineer. A minimum one-year warranty period commencing from the date the easement plat is recorded or the PTO is received, whichever is later, is required for all new wastewater systems. A longer warranty period may be required under special circumstances as determined by the City Engineer. The owner/developer must warrant the newly installed system:

- To be free from defects and flaws in design, workmanship, and materials.
- Strictly conforms to the requirements of the City of Greenville.
- To be fit, sufficient and suitable for the purposes expressed in, or reasonably inferred to, by the as-built drawings.

As part of the warranty agreement, the owner/developer shall, promptly and without charge to the City, repair, replace, or otherwise remedy such defects that may be discovered or develop at any time within the warranty period to the full and complete satisfaction of the City. The warranty shall be extended automatically to cover all repaired and replacement parts and labor provided or performed under the warranty for a period of one year from the date of such repair or replacement. Additionally, the obligation to maintain the system by the



owner/developer shall be extended for a period of one year from the date of such repair or replacement. At the conclusion of the declared warranty period, the City will inspect the new wastewater system. If the system is performing appropriately, the City will take over full responsibility for operation and maintenance of the system, and a final acceptance letter will be issued to the owner/developer and engineer.

As security to the City for the performance by the owner/developer of the aforesaid warranty obligations, the owner/developer shall post a bond, or acceptable equivalent, in an amount equal to 50 percent of the installed construction price. This amount may be adjusted up or down dependent on the associated elements of risk which include, but are not limited to, an engineering assessment of the soil conditions, installation practice, depth of cover, linear footage of line, number of manholes, and anticipated subsequent construction activity immediately adjacent to the installed mains. A typical Maintenance/Warranty Period Bond is included in Appendix D.

8.8 Inspection and Testing Requirements

General All new construction of and modifications to wastewater mains, whether public or private, shall be inspected by the City of Greenville Construction Inspection Bureau. Service lateral connections must meet the permitting and inspections requirements described in Section 8.6. Construction must be in accordance with the approved plans, City standard details and specifications. A copy of the PTC and one set of approved stamped construction drawings must be kept on site at all times during construction and accessible to the Inspector. Any modifications to the approved stamped construction drawings must be submitted to the City by the permitting engineer for review and approval prior to installation of the modification as well as any other affected portion of the approved system. A mandatory pre-construction meeting with the City Inspector, contractor and any related sub-contractors, owner/developer, and engineer must be completed as described in the PTC requirements above.

The City Inspector and the permitting engineer, or his designee, must be present for all final performance tests. The contractor must schedule all required inspections at least 72 hours in advance with the Construction Inspection Bureau. The contractor must also notify the permitting engineer in advance of the performance of the tests. Final performance tests may be performed only after all adjacent underground utilities have been installed and all manholes have been backfilled and finished to final grade or 30 days after installation and backfill, whichever is later. The contractor is encouraged to perform a pretest of the system. Pretests may be performed with the City Inspector but will not constitute a final performance test.

Pipe Inspection The City Inspector will observe the laying techniques to determine if they are appropriate for the soil conditions and the type of pipe. The Inspector will verify that all materials used comply with City of Greenville standards. The contractor may be required to produce supporting documentation that City of Greenville standards are being met. Work



stoppages may result if the inspector can not satisfactorily verify that the work is in compliance with the established standards.

After the lines are laid, but prior to building the flow channel between the inverts (in manholes without precast flow channels), the sewer line system, including the service connection stub outs, shall be air pressure tested in accordance with City of Greenville specifications and ASTM F1417, or other test acceptable to the City Engineer. If any section of pipe fails, it shall be fully replaced from the nearest upstream manhole to the nearest downstream manhole. New sewer lines shall not be repaired or patched in any way in order that the failed section subsequently passes the air pressure test.

Main lines constructed of PVC material will be subject to the GO/NO-GO five percent deflection mandrel test. This test may be performed during the same inspection period as the air pressure test. Mandrel testing should be performed prior to building the flow channel between the inverts (in manholes without precast flow channels) to facilitate easy insertion and removal of the mandrel at manholes.

The City Inspector will perform a visual inspection of all lines, regardless of pipe material, using lamps, video camera or other technology. If there is any settlement or slope loss of the sewer main as it enters and or leaves a manhole, the line shall be uncovered and raised to proper alignment. If in the assessment of the Inspector there is excessive misalignment of the pipe between manholes, the entire line shall be exhumed and re-laid.

Manhole Inspection The City Inspector will observe the installation techniques to determine if they are appropriate for the in-situ conditions. The Inspector will verify that all materials used comply with City of Greenville standards. The contractor may be required to produce supporting documentation that City of Greenville standards are being met. Work stoppages may result if the inspector can not satisfactorily verify that the work is in compliance with the established standards. The Inspector will check all the flow channels between inverts and all benches for proper construction. Pipes shall be smoothly cut flush with the inside wall of the manhole. The Inspector shall also inspect all manholes to ensure that lift holes, joints and rings are mortared smooth in accordance with City standards details and specifications. In order to be accepted, there shall be no signs of infiltration into the manhole. The Inspector will verify proper alignment of the ring and cover and all sections of the manhole. The Inspector will also verify that the ring and cover are at appropriate grade.

Additionally, the City Inspector will observe a vacuum test of the manholes in accordance with City of Greenville specifications and ASTM C1244. All connections, benches, and flow channels shall be installed prior to testing. If a coating or lining is to be applied to the interior of the manhole, the vacuum test must not be performed until the coating or lining has been cured according to the manufacturer's recommendations. Failing manholes shall be sealed with non-



shrink grout or other sealant approved by the City Engineer and retested. Repeat failures will require new installation.

8.9 Definitions

Unless the context specifically indicates otherwise, the meaning of terms used herein shall be as follows:

Appurtenance – Any accessory object or component connected to a public sewer.

As-built Drawings – As-built drawings must be prepared, signed and sealed by a Professional Land Surveyor licensed in the State of South Carolina. Horizontal survey datum control shall be based upon, and referenced to, South Carolina State Plane, NAD83 HARN, International Feet coordinates. Vertical Survey Datum control shall be based upon, and referenced to, the North American Vertical Datum of 1988 (NAVD 88).

Average Daily Flow – The average dry weather flow rate during a typical 24 hour period of normal usage measured over a 30 day period.

City Inspector or Inspector – Designee of the City Engineer for the purposes of observation, inspection and testing of public improvements.

Domestic Waste – The waste produced from non-commercial or non-industrial activities, and which result from normal human living processes, which are of substantially similar origin and strength to those typically produced in households, including waste from sanitary conveniences.

Easement – A permanent non-possessory interest to use real property for the purposes to construct, operate, control, maintain, reconstruct, or remove a public utility and appurtenances along, under, and across said easement.

Flood Protection Elevation – As defined in the City of Greenville Stormwater Ordinance, “the elevation of the base flood elevation plus two feet of freeboard required and four feet of freeboard recommended at the discretion of the Administrator or designee.”

Force Main – A sewer line that carries sewage under positive pressure.

Gravity sewer – A collection system where gravity is used to transport wastewater from the customer's premises to a centralized collection or pumping facility.



Grease Trap – Device which collects organic substances including fats, vegetable and mineral oils, waxes, fatty acids from soaps, and other hydrocarbons before they enter the sewer system thus reducing the risk of adhesion problems in sewers.

Grinder Pump – A compact lift or pump station with pump(s), storage capacity and appurtenant piping, valves and other mechanical and electrical equipment which grinds or reduces the particle size of wastewater solids to yield a sewage slurry and which conveys the waste from its source to a gravity sanitary sewage collection system or a sewage force main.

Hydraulic Grade Line – Measure of pressure head available at specific points within a sewer system. The hydraulic grade line is a line connecting the points to which the liquid would rise at various places along any pipe if piezometer tubes were inserted in the liquid within the pipe.

Industrial Waste – liquid and liquid carried waste resulting from industrial, manufacturing, trade or business processes, including industrial cooling water and unpolluted trade or process waste, as distinguished from domestic waste.

Infiltration – Groundwater that enters the sewer system via such means as pipe cracks, joints, connections, or defects in manhole structures.

Inflow – Surface water which enters the sanitary sewer system via an illegal drain connection (foundation drain, roof drain, yard drain, inlet structure, storm sewer cross connection, or sump pump) or from sources such as leaks around manhole covers.

Peak Daily Flow – The maximum flow rate determined by use of the appropriate peaking factor times the average daily flow or as measured directly over a 30 day period for existing developed areas.

Public Sewer – Sewer to the use of which all owners of abutting property have equal rights to and is controlled and maintained by the City of Greenville or other public authority.

Pump Station – Any arrangement of pumps, piping, valves, and controls which convey wastewater to or over a higher elevation.

Service Area – A geographical area served by a public utility or wastewater collection system.

Service Connection – An individual gravity sewer line, or an individual pump station and force main, serving only one (1) building or one (1) residential lot with domestic or industrial wastewater connecting to a gravity sewer system. Oil/water separators, pH adjustment systems, and other similar simple industrial wastewater treatment systems (as determined by DHEC) will be considered a component of the service connection when a local pretreatment permit is not required. A service connection does not include the following:



- a. Individual connections, where at the time of connection, design flow contributions are greater than five (5) percent of the existing wastewater treatment facility's design capacity, or generates flows greater than fifty thousand (50,000) gallons per day.
- b. Individual connections to force main sewers and vacuum sewer connections beginning with the valve pit.
- c. A gravity sewer line or pump station and force main serving more than one (1) building or more than one (1) residential lot.
- d. Sewer lines that have the reasonable ability to serve any additional projects and/or buildings in the future.

Springline – In a transverse cross section of pipe, the line of maximum horizontal dimension.

Structure – Anything constructed or erected that requires permanent location on the surface of the land. The term "structure" does not include features such as walkways, driveways, recreational courts, flagpoles, light standards, or mailboxes.

Stub – Short length of sewer segment tapped into existing system allowing for future connection.

Temporary Easement – The temporary use of land for the purposes of constructing and placing in operation a sewer and its appurtenances. The temporary sewer easement shall expire a minimum of one year from the date of adoption by the Board of Public Works and Safety, or on the date specified in the easement instrument.

Ten State Standards – “Recommended Standards for Wastewater Facilities of the Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers.” Latest Edition.

Travel Way – The portion of a street or other traversable way over which a vehicle customarily passes. The travel way is typically identified as the full width of a street measured from face of curb to the opposite face of curb.

Travel Lane – The portion of a street or other traversable way over which a vehicle customarily passes in one direction. The travel lane is typically identified as the width measured from the face of curb to the centerline of the street.

Wastewater – The water supply of a City after it has been fouled by a variety of uses. From the standpoint of sources of generation, wastewater may be defined as a combination of the liquid- or water-carried wastes removed from residences, institutions, and commercial and industrial establishments.

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chapter 9

STORMWATER DESIGN CRITERIA

Note: This chapter is under construction. While the full Technical Reference Manual, as referenced in the ordinance, will be included in the appendices of this manual, this chapter will provide a comprehensive review of the stormwater program requirements. The objectives for stormwater planning, stormwater quantity and quality considerations, and the preservation of natural creeks and streams will be discussed. General design considerations like hydrology methods, detention requirements, analysis of downstream system requirements, functional design and design life of stormwater drainage systems and detention structures, and low impact development methods will also be presented. Finally, permanent maintenance agreements and facility access easements will be reviewed.

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chapter 10

RESERVED

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chapter 11

SITE CONSTRUCTION ADMINISTRATION

Note: This chapter is under construction. This chapter will discuss the preconstruction conference, inspection frequency, required submittals and notifications, erosion and sediment control monitoring, penalties for non-compliance, development certifications, and the bond release process as it relates to all projects within the City.

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chapter 12

SITE CONSTRUCTION ACTIVITIES

Note: This chapter is under construction. This chapter will discuss general measures that should be followed on all construction projects for success and for the safety and general welfare of the public. The role of construction phasing, good housekeeping and other BMP measures, waste management, maintenance of stormwater facilities during construction, notifications of spills and other releases, and emergency contacts will be discussed.

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chapter 13

RIGHT-OF-WAY & ENCROACHMENT MANAGEMENT

Note: This chapter is under construction. The encroachment permit process and enforcement measures will be discussed in this chapter. Driveway construction, temporary street and sidewalk closures, construction container management, and required forewarning signage will all be discussed.

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APPENDIX A

DESIGN AND SPECIFICATIONS MANUAL

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revisions

August 2008: Initial release.

June 2010: Additional details added to 2000 Division, Wastewater Utility.

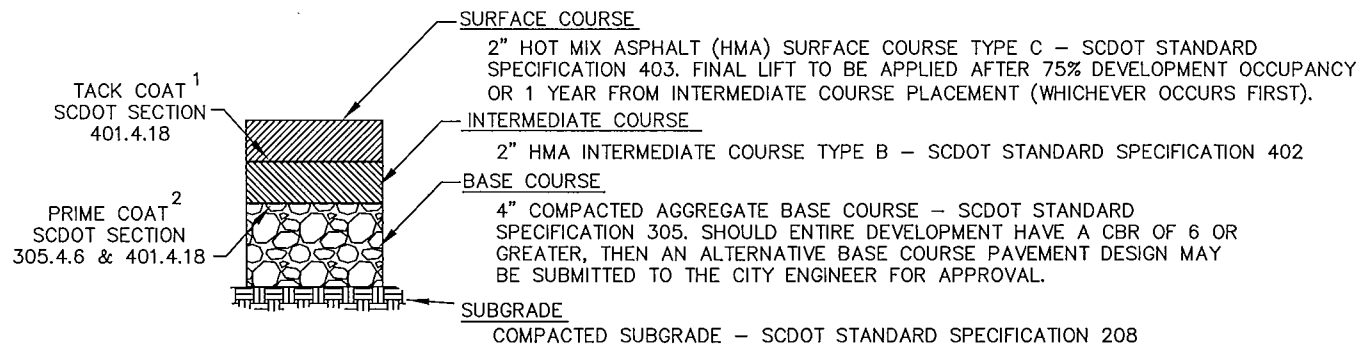
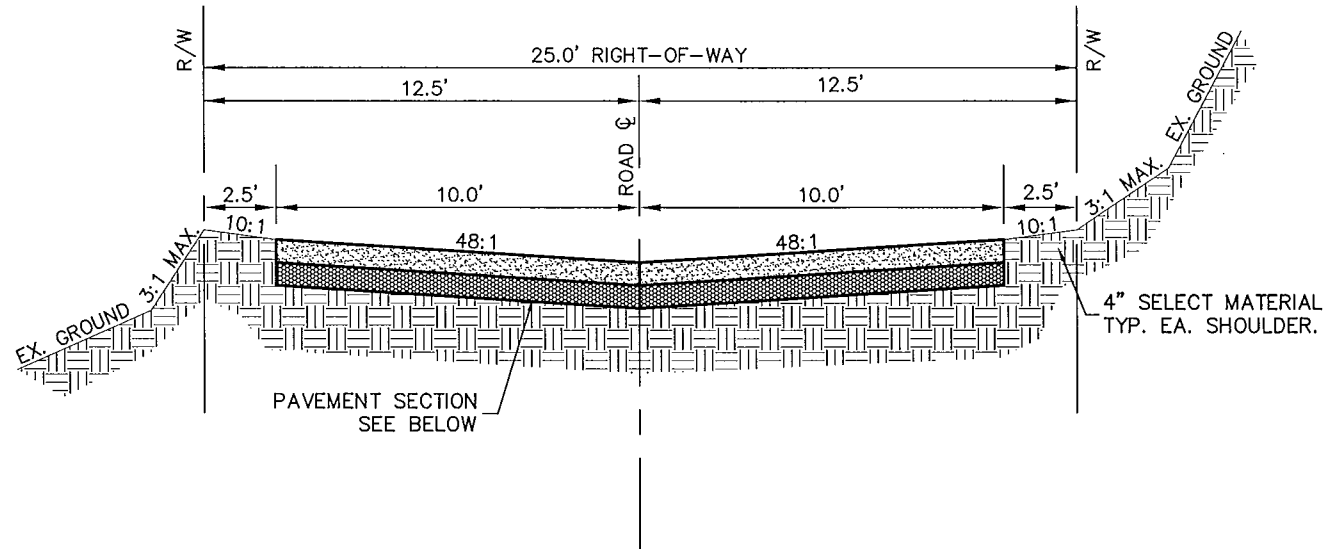
January 2013: Updated standard Erosion Prevention and Sediment Control Notes, Detail 39:00.



appendix A

STANDARD DETAILS AND NOTES

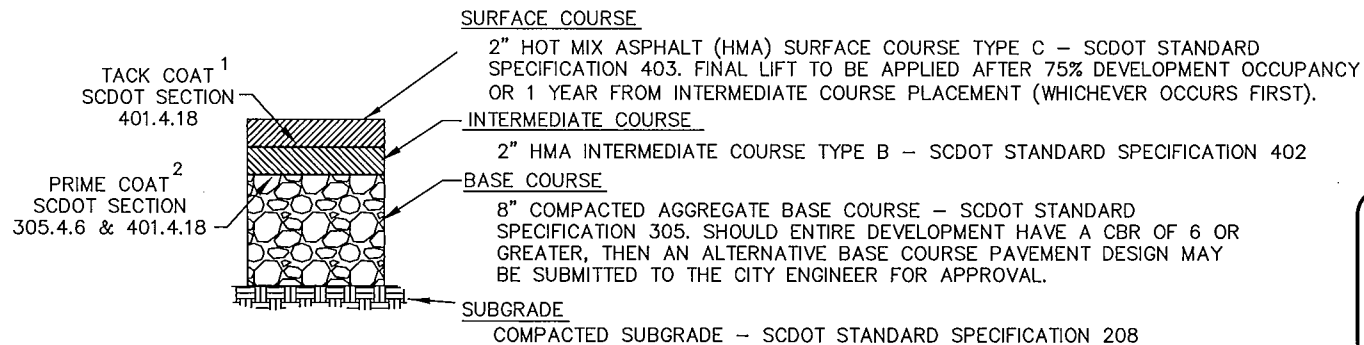
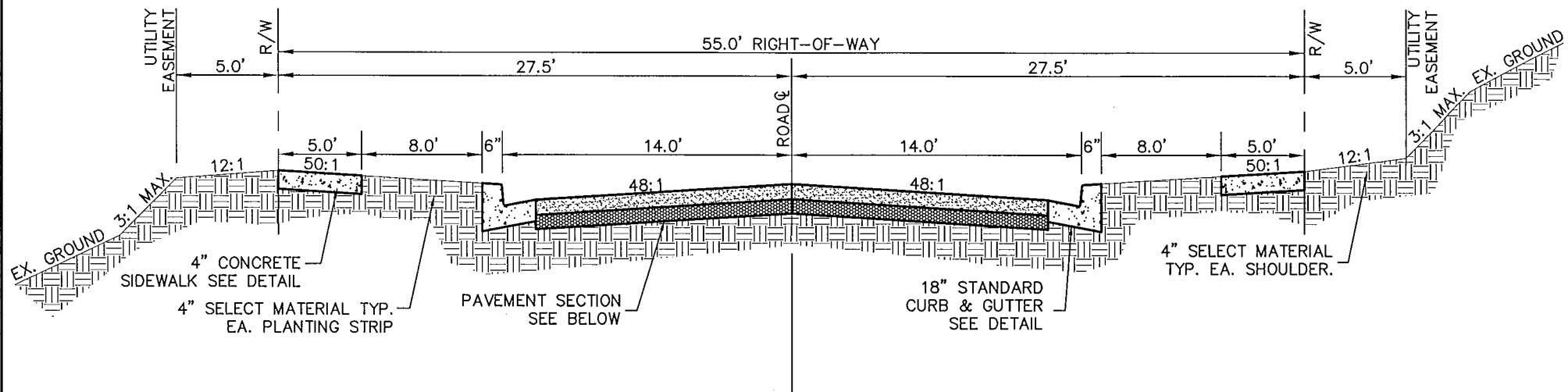
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1000 Division: GENERAL CIVIL	
10:00 Streets	
11:00 Curb, Gutter, and Sidewalk	
12:00 Miscellaneous Street Elements	
13:00 Driveways	
14:00 Handicap Accessibility	
15:00 Parking Facility Standards	
16:00 Non-Street Pavement Sections	
2000 Division: WASTEWATER UTILITY	
20:00 Ring and Cover	
21:00 Manhole and Appurtenances	
22:00 Pipe Material and Spacing Requirements	
23:00 Pipe Bedding and Utility Cut Standards	
24:00 Miscellaneous Pipe Details	
25:00 Service Connection and Related Elements	
29:00 Wastewater General Notes	
3000 Division: EROSION PREVENTION AND SEDIMENT CONTROL	
39:00 EPSC Best Management Practices	
4000 Division: STORMWATER UTILITY	



TYPICAL PAVEMENT SECTION

1. APPLICATION RATE FOR LAYING ANY HMA ON EXISTING PAVEMENTS SHALL BE
0.05 - 0.15 GAL PER SQUARE YARD

2. APPLICATION RATE FOR MACADAM AND RECYCLED PORTLAND CEMENT BASE
COURSE SHALL BE 0.25 - 0.30 GAL PER SQUARE YARD



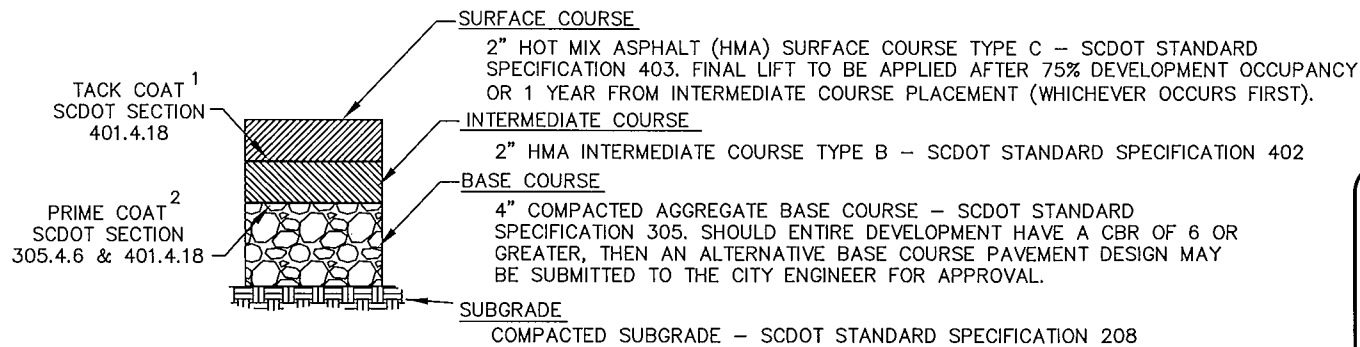
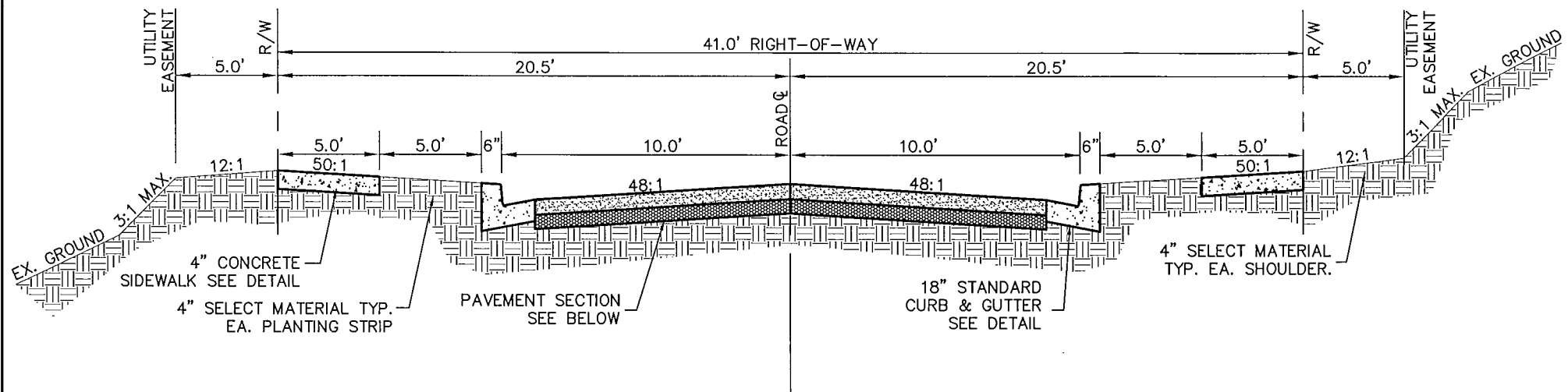
TYPICAL PAVEMENT SECTION

1. APPLICATION RATE FOR LAYING ANY HMA ON EXISTING PAVEMENTS SHALL BE 0.05 - 0.15 GAL PER SQUARE YARD
2. APPLICATION RATE FOR MACADAM AND RECYCLED PORTLAND CEMENT BASE COURSE SHALL BE 0.25 - 0.30 GAL PER SQUARE YARD

NOTE

THIS TYPICAL SECTION MAY BE USED IF ALL OF THE FOLLOWING CONDITIONS ARE MET:

1. SINGLE FAMILY NET DENSITIES ALONG THE STREET ARE BELOW 15 UNITS PER ACRE.
2. THERE IS SUFFICIENT ON-SITE PARKING TO ALLOW FOR 2 VEHICLES PER UNIT FOR SINGLE FAMILY DEVELOPMENT AND 1.5 VEHICLES PER UNIT FOR MULTIFAMILY DEVELOPMENTS.
3. PREDICTED VOLUME IS LESS THAN OR EQUAL TO 1500 VEHICLES PER DAY.



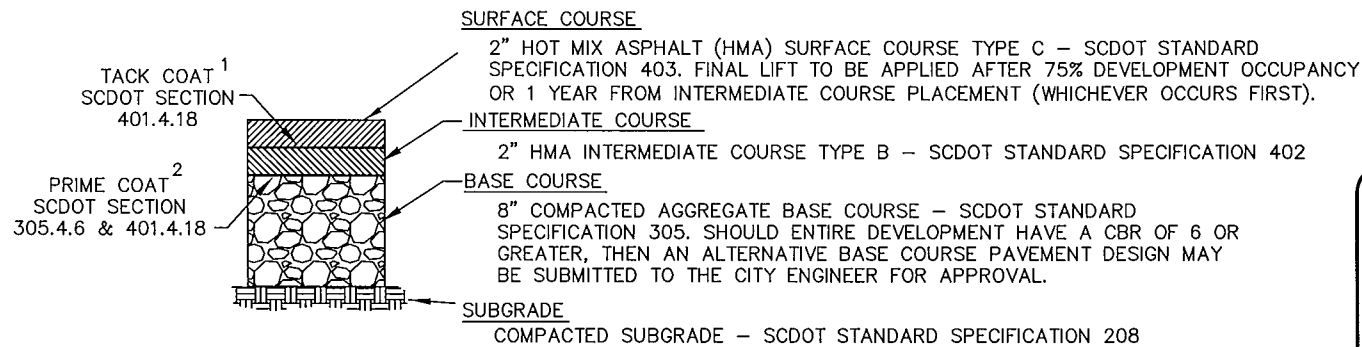
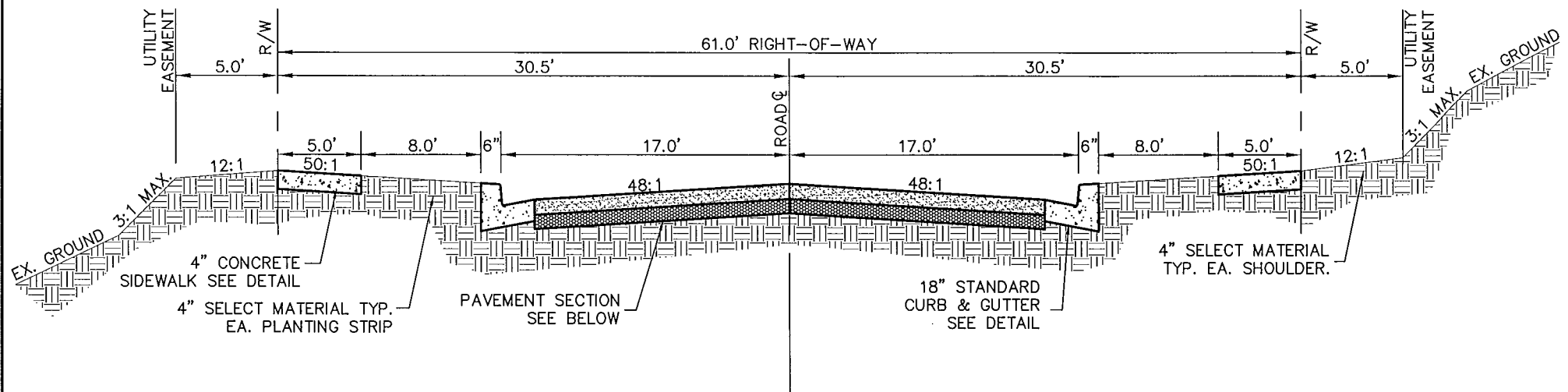
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2. APPLICATION RATE FOR MACADAM AND RECYCLED PORTLAND CEMENT BASE COURSE SHALL BE 0.25 - 0.30 GAL PER SQUARE YARD

NOTE

THIS TYPICAL SECTION MAY BE USED IF ALL OF THE FOLLOWING CONDITIONS ARE MET:

1. SINGLE FAMILY R-9 OR NET DENSITIES ALONG THE STREET ARE BELOW 5 UNITS PER ACRE.
2. LOT FRONTAGE ALONG THE STREET IS AT LEAST 60' WIDE.
3. PREDICTED VOLUME IS EQUAL TO OR LESS THAN 300 VEHICLES PER DAY.
4. LOCAL LOW VOLUME RESIDENTIAL STREETS MAY NOT TERMINATE WITH A CUL-DE-SAC OR EQUIVALENT WITHOUT PRIOR APPROVAL BY THE CITY ENGINEER.



TYPICAL PAVEMENT SECTION

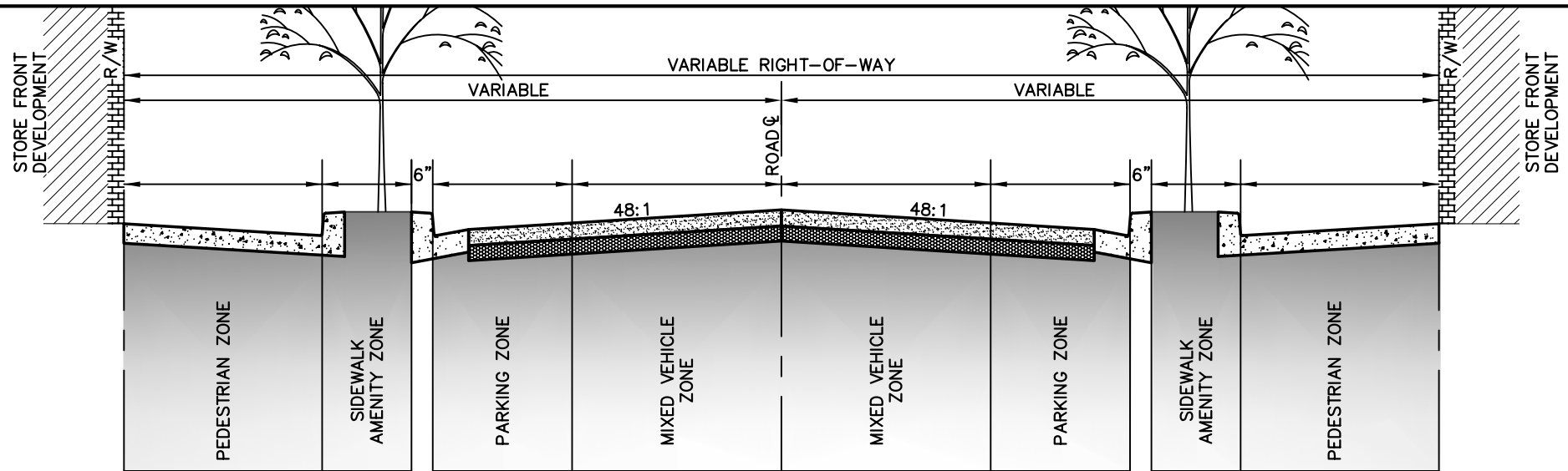
1. APPLICATION RATE FOR LAYING ANY HMA ON EXISTING PAVEMENTS SHALL BE 0.05 – 0.15 GAL PER SQUARE YARD

2. APPLICATION RATE FOR MACADAM AND RECYCLED PORTLAND CEMENT BASE COURSE SHALL BE 0.25 – 0.30 GAL PER SQUARE YARD

NOTE

THE PREDICTED VOLUME FOR THIS TYPICAL SECTION IS LESS THAN OR EQUAL TO 1500 VEHICLES PER DAY. THIS TYPICAL SECTION SHALL BE USED WHEN:

1. SINGLE FAMILY NET DENSITIES ALONG THE STREET ARE 15 UNITS PER ACRE OR GREATER.
2. THERE IS NOT SUFFICIENT ON-SITE PARKING TO ALLOW FOR 2 VEHICLES PER UNIT FOR SINGLE FAMILY DEVELOPMENT OR 1.5 VEHICLES PER UNIT FOR MULTIFAMILY DEVELOPMENTS.
3. BUMP OUTS OF THE CURB LINE TO REDUCE IMPERVIOUS SURFACES AND PROVIDE TRAFFIC CALMING ARE ENCOURAGED.



1. THE DESIGN GUIDELINES FOR NON-LOCAL THOROUGHFARES ARE NOT ENTIRELY PRESCRIPTIVE BUT SHOULD INCLUDE AN ARRANGEMENT OF THE ZONES DESCRIBED HEREIN. THE DESIGN ENGINEER SHALL COORDINATE A PROPOSED TYPICAL SECTION WITH THE CITY ENGINEER IN A PRE-DESIGN CONFERENCE.

2. THE TOTAL RIGHT-OF-WAY WIDTH WILL VARY DEPENDING ON THE ARRANGEMENT AND DIMENSIONS OF EACH ZONE AS APPROVED IN THE PRE-DESIGN CONFERENCE.

MIXED VEHICLE ZONE

3. TYPICALLY HIGHLY URBANIZED MAIN STREETS HAVE ONE TRAVEL LANE IN EACH DIRECTION. HOWEVER IN CERTAIN SITUATIONS THEY MAY HAVE 3 TOTAL LANES DEPENDING ON PREDICTED TRAFFIC VOLUMES. IN ALL CASES, TRAVEL LANE WIDTHS SHALL BE A MINIMUM 11' WIDE. WIDER TRAVEL LANES WILL BE NECESSARY WHERE ON-STREET PARKING IS PROVIDED.

4. WHILE THE 3-LANE CROSS SECTION WITH A CENTER, TWO-WAY-LEFT-TURN-LANE (TWLTL) ARE NOT TYPICALLY EXPECTED ON MAIN STREETS, THEY MAY BE PROVIDED SO LONG AS THE TWLTL IS A MINIMUM 12' WIDE. IF THE CENTER LANE IS PROPOSED TO BE A PLANTED MEDIAN WITH INTERMITTENT TURN LANES, THE CENTER LANE SHOULD TYPICALLY BE 16' WIDE TO PROVIDE A MINIMUM 6' PEDESTRIAN REFUGE AND A 10' TURN LANE. IN NO CASE SHOULD A PLANTED MEDIAN BE LESS THAN 6' WIDE MEASURED FACE-OF-CURB TO FACE-OF-CURB.

PARKING ZONE

5. ON-STREET PARKING IS DESIRABLE IN AREAS WITH FRONT FACING COMMERCIAL DEVELOPMENT AND IN HIGH DENSITY RESIDENTIAL AREAS WHERE ON-STREET PARKING IS EXPECTED. ON-STREET PARKING SHOULD BE CLEARLY MARKED. PARALLEL LANES MUST BE A MINIMUM OF 7' WIDE AND MARKED PER THE APPLICABLE DETAIL. ANGLED PARKING SHALL FOLLOW CITY DESIGN GUIDELINES AND DIMENSIONAL STANDARDS.

SIDEWALK AMENITY ZONE

6. THIS ZONE ENHANCES THE PEDESTRIAN ENVIRONMENT ALONG A MAIN STREET AND SHOULD INCLUDE STREET TREES, LIGHTS, FURNITURE (LIKE OUTDOOR DINING), AND OTHER AMMENITIES. THE MINIMUM WIDTH PROVIDED SHALL BE 8', UNLESS APPROVED OTHERWISE BY THE CITY ENGINEER AND THE CITY URBAN DESIGNER.

PEDESTRIAN ZONE

7. AN 8' WIDE UNOBSTRUCTED SIDEWALK SHOULD BE PROVIDED ON BOTH SIDES OF A MAIN STREET SECTION UNLESS APPROVED OTHERWISE BY THE CITY ENGINEER AND THE CITY URBAN DESIGNER. IN NO CASE SHALL THE UNOBSTRUCTED SIDEWALK WIDTH BE LESS THAN 6'.

OTHER CONSIDERATIONS

8. THE DESIGN ENGINEER SHALL PROVIDE A PROPOSED STRUCTURAL PAVEMENT SECTION BASED ON GEOTECHNICAL ANALYSIS OF THE EXISTING CONDITIONS AS WELL AS EXPECTED TRAVEL VOLUMES & TYPES. IN NO CASE SHALL THE PAVEMENT SECTION BE LESS THAN THE TYPICAL PAVING SECTION DETAIL FOR COLLECTORS AND ARTERIALS.

9. STANDARD 18" CURB & GUTTER AND SIDEWALK PER CITY OF GREENVILLE STANDARD DETAILS.

10. STREET LIGHTS SHALL CONFORM TO THE CITY OF GREENVILLE LIGHT POLLUTION ORDINANCE (CHAPTER 19, ARTICLE 10). REFER TO 19-487 FOR PERMIT APPLICATION REQUIREMENTS. LOCATION AND TYPE OF PROPOSED STREET LIGHTS, HEIGHT OF POLE, AND PHOTOMETRIC SURVEY SHALL BE PROVIDED.

 city of
greenville
ENGINEERING DIVISION

MAIN STREET

DATE
APPROVED: **AUG. 2008**

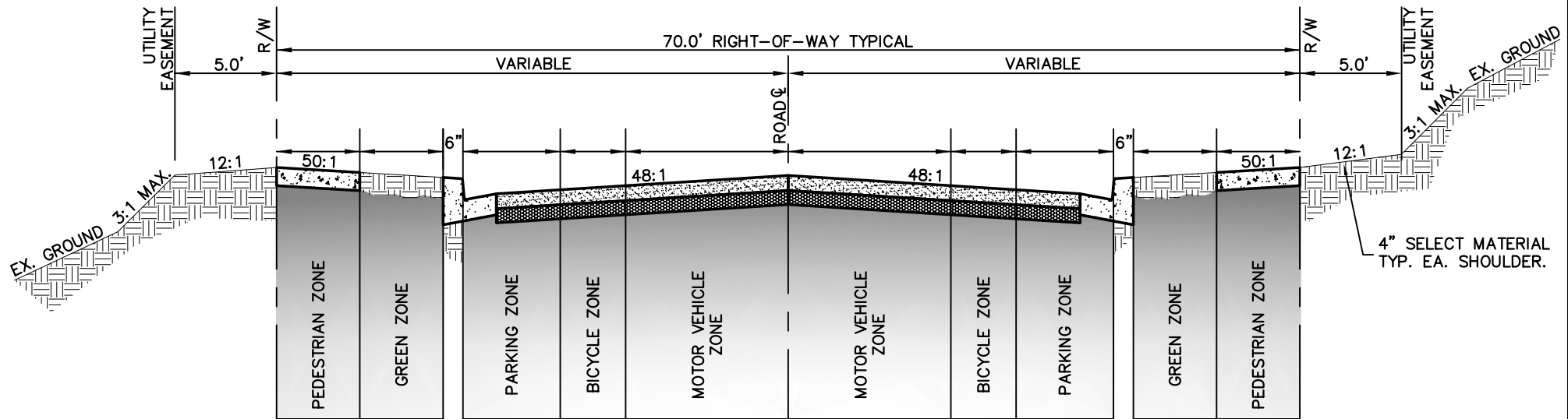
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CITY ENGINEER:

Philip B. Lindsey

SCALE:
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10:04



1. THE DESIGN GUIDELINES FOR NON-LOCAL THOROUGHFARES ARE NOT ENTIRELY PRESCRIPTIVE BUT SHOULD INCLUDE AN ARRANGEMENT OF THE ZONES DESCRIBED HEREIN. THE DESIGN ENGINEER SHALL COORDINATE A PROPOSED TYPICAL SECTION WITH THE CITY ENGINEER IN A PRE-DESIGN CONFERENCE.

2. THE TOTAL RIGHT-OF-WAY WIDTH MAY VARY FROM THE TYPICAL DIMENSION LISTED ABOVE DEPENDING ON THE ARRANGEMENT AND DIMENSIONS OF EACH ZONE AS APPROVED IN THE PRE-DESIGN CONFERENCE.

MOTOR VEHICLE ZONE

3. TYPICALLY COLLECTORS HAVE ONE TRAVEL LANE IN EACH DIRECTION, HOWEVER IN CERTAIN SITUATIONS THEY MAY HAVE 3, 4, OR 5 TOTAL LANES DEPENDING ON PREDICTED TRAFFIC VOLUMES. IN ALL CASES, TRAVEL LANE WIDTHS SHALL BE A MINIMUM 11' WIDE.

4. WHILE 3- AND 5-LANE CROSS SECTIONS WITH A CENTER, TWO-WAY-LEFT-TURN-LANE (TWLTL) ARE NOT TYPICALLY EXPECTED ON COLLECTORS, THEY MAY BE PROVIDED SO LONG AS THE TWLTL IS A MINIMUM 12' WIDE. IF THE CENTER LANE IS PROPOSED TO BE A PLANTED MEDIAN WITH INTERMITTENT TURN LANES, THE CENTER LANE SHOULD TYPICALLY BE 16' WIDE TO PROVIDE A MINIMUM 6' PEDESTRIAN REFUGE AND A 10' TURN LANE. IN NO CASE SHOULD A PLANTED MEDIAN BE LESS THAN 9' WIDE MEASURED FACE-OF-CURB TO FACE-OF-CURB.

BICYCLE ZONE

5. DEDICATED BICYCLE LANES SHOULD BE PROVIDED ON ALL COLLECTORS. BICYCLE LANES SHALL BE A MINIMUM 5' WIDE. THE DESIGN ENGINEER IS ENCOURAGED TO REVIEW AASHTO'S *GUIDE FOR THE DEVELOPMENT OF BICYCLE FACILITIES* FOR FURTHER DESIGN CONSIDERATIONS.

PARKING ZONE

6. ON-STREET PARKING IS DESIRABLE IN AREAS WITH FRONT FACING COMMERCIAL DEVELOPMENT AND IN HIGH DENSITY RESIDENTIAL AREAS WHERE ON-STREET PARKING IS EXPECTED. ON-STREET PARKING, WHEN PROVIDED, SHOULD BE MARKED, PARALLEL LANES A MINIMUM OF 7' WIDE. PLEASE REFERENCE THE TYPICAL PARALLEL PARKING DETAIL FOR THE CITY OF GREENVILLE STRIPING STANDARD.

GREEN ZONE

7. PLANTING STRIPS SHALL BE PROVIDED ALONG BOTH SIDES OF A COLLECTOR. THE MINIMUM PLANTING STRIP WIDTH SHALL BE 8' (MEASURED FROM BACK-OF-CURB TO EDGE OF SIDEWALK), UNLESS APPROVED OTHERWISE BY THE CITY ENGINEER. THE TOP 4" OF THE PLANTING STRIP SHALL BE SELECT MATERIAL SUFFICIENTLY CAPABLE OF GROWING AND SUSTAINING VEGETATION.

PEDESTRIAN ZONE

8. A MINIMUM 5' WIDE UNOBSTRUCTED SIDEWALK SHALL BE PROVIDED ON BOTH SIDES OF A COLLECTOR.

OTHER CONSIDERATIONS

9. THE DESIGN ENGINEER SHALL PROVIDE A PROPOSED STRUCTURAL PAVEMENT SECTION BASED ON GEOTECHNICAL ANALYSIS OF THE EXISTING CONDITIONS AS WELL AS EXPECTED TRAVEL VOLUMES & TYPES. IN NO CASE SHALL THE PAVEMENT SECTION BE LESS THAN THE TYPICAL PAVING SECTION DETAIL FOR COLLECTORS AND ARTERIALS.

10. STANDARD 18" CURB & GUTTER AND SIDEWALK PER CITY OF GREENVILLE STANDARD DETAILS.

11. STREET LIGHTS SHALL CONFORM TO THE CITY OF GREENVILLE LIGHT POLLUTION ORDINANCE (CHAPTER 19, ARTICLE 10). REFER TO 19-487 FOR PERMIT APPLICATION REQUIREMENTS. LOCATION AND TYPE OF PROPOSED STREET LIGHTS, HEIGHT OF POLE, AND PHOTOMETRIC SURVEY SHALL BE PROVIDED.



COLLECTOR

DATE
APPROVED: **AUG. 2008**

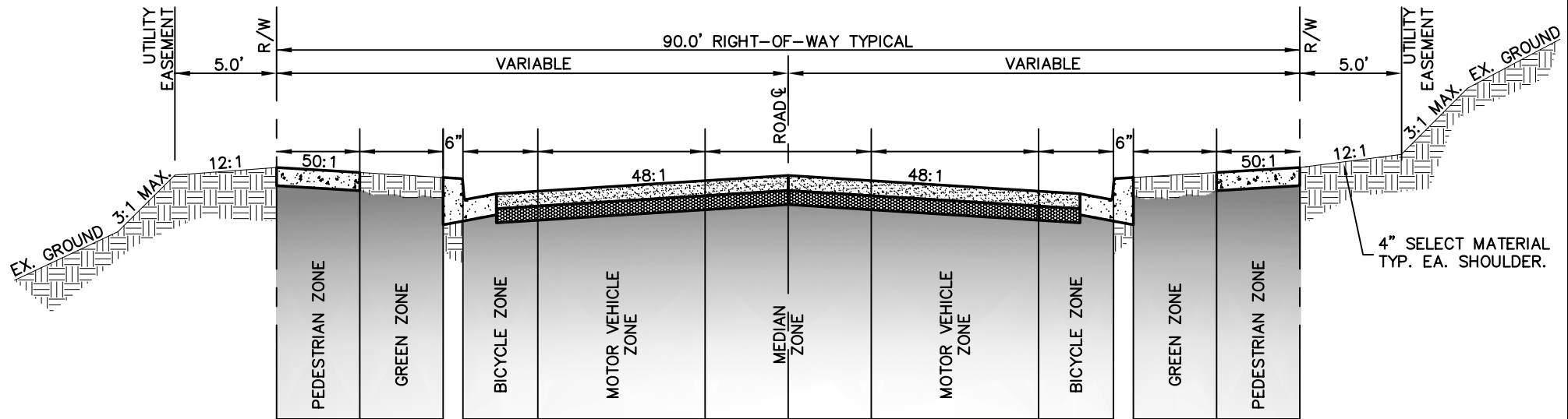
OFFICE OF THE
CITY ENGINEER:

Philip B. Lindsey

SCALE:
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DETAIL :

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1. THE DESIGN GUIDELINES FOR NON-LOCAL THOROUGHFARES ARE NOT ENTIRELY PRESCRIPTIVE BUT SHOULD INCLUDE AN ARRANGEMENT OF THE ZONES DESCRIBED HEREIN. THE DESIGN ENGINEER SHALL COORDINATE A PROPOSED TYPICAL SECTION WITH THE CITY ENGINEER IN A PRE-DESIGN CONFERENCE.

2. THE TOTAL RIGHT-OF-WAY WIDTH MAY VARY FROM THE TYPICAL DIMENSION LISTED ABOVE DEPENDING ON THE ARRANGEMENT AND DIMENSIONS OF EACH ZONE AS APPROVED IN THE PRE-DESIGN CONFERENCE.

MEDIAN ZONE

3. TYPICALLY A MEDIAN SHOULD BE PROVIDED. A CENTER, TWO-WAY-LEFT-TURN-LANE (TWLTL) SHALL BE A MINIMUM 12' WIDE. IF THE CENTER LANE IS PROPOSED TO BE A PLANTED MEDIAN WITH INTERMITTENT TURN LANES, THE CENTER LANE SHOULD TYPICALLY BE 16' WIDE TO PROVIDE A MINIMUM 6' PEDESTRIAN REFUGE AND A 10' TURN LANE. IN NO CASE SHOULD A PLANTED MEDIAN BE LESS THAN 9' WIDE MEASURED FACE-OF-CURB TO FACE-OF-CURB.

MOTOR VEHICLE ZONE

4. TYPICALLY ARTERIALS HAVE TWO TRAVEL LANES IN EACH DIRECTION. TRAVEL LANE WIDTHS SHALL BE A MINIMUM 11' WIDE.

BICYCLE ZONE

5. DEDICATED BICYCLE LANES SHOULD BE PROVIDED ON ALL ARTERIALS. BICYCLE LANES SHALL BE A MINIMUM 5' WIDE. THE DESIGN ENGINEER IS ENCOURAGED TO REVIEW AASHTO'S *GUIDE FOR THE DEVELOPMENT OF BICYCLE FACILITIES* FOR FURTHER DESIGN CONSIDERATIONS.

GREEN ZONE

6. PLANTING STRIPS SHALL BE PROVIDED ALONG BOTH SIDES OF AN ARTERIAL. THE MINIMUM PLANTING STRIP WIDTH SHALL BE 8' (MEASURED FROM BACK-OF-CURB TO EDGE OF SIDEWALK), UNLESS APPROVED OTHERWISE BY THE CITY ENGINEER. THE TOP 4" OF THE PLANTING STRIP SHALL BE SELECT MATERIAL SUFFICIENTLY CAPABLE OF GROWING AND SUSTAINING VEGETATION.

PEDESTRIAN ZONE

7. A MINIMUM 5' WIDE UNOBSTRUCTED SIDEWALK SHALL BE PROVIDED ON BOTH SIDES OF AN ARTERIAL.

OTHER CONSIDERATIONS

8. THE DESIGN ENGINEER SHALL PROVIDE A PROPOSED STRUCTURAL PAVEMENT SECTION BASED ON GEOTECHNICAL ANALYSIS OF THE EXISTING CONDITIONS AS WELL AS EXPECTED TRAVEL VOLUMES & TYPES. IN NO CASE SHALL THE PAVEMENT SECTION BE LESS THAN THE TYPICAL PAVING SECTION DETAIL FOR COLLECTORS AND ARTERIALS.

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 city of
greenville
ENGINEERING DIVISION

ARTERIAL

DATE
APPROVED: **AUG. 2008**

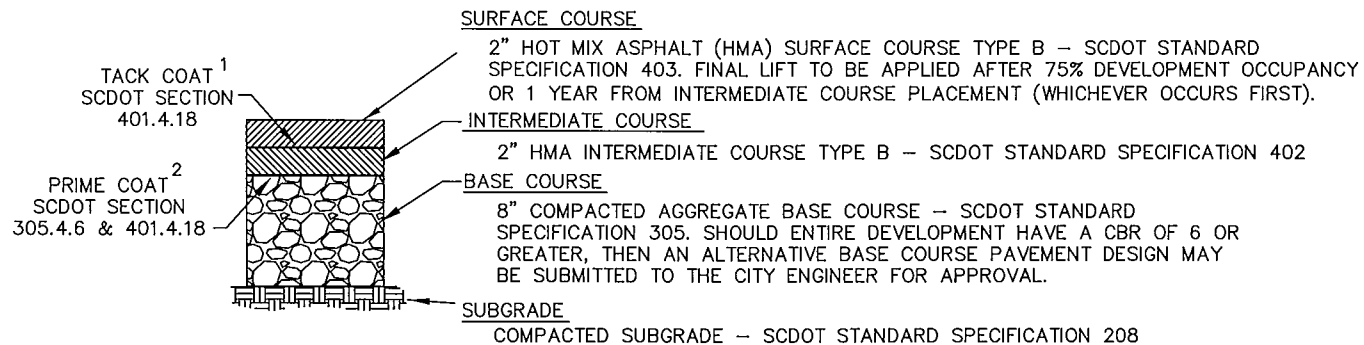
OFFICE OF THE
CITY ENGINEER:

Philip B. Lindsey

SCALE:
NO SCALE

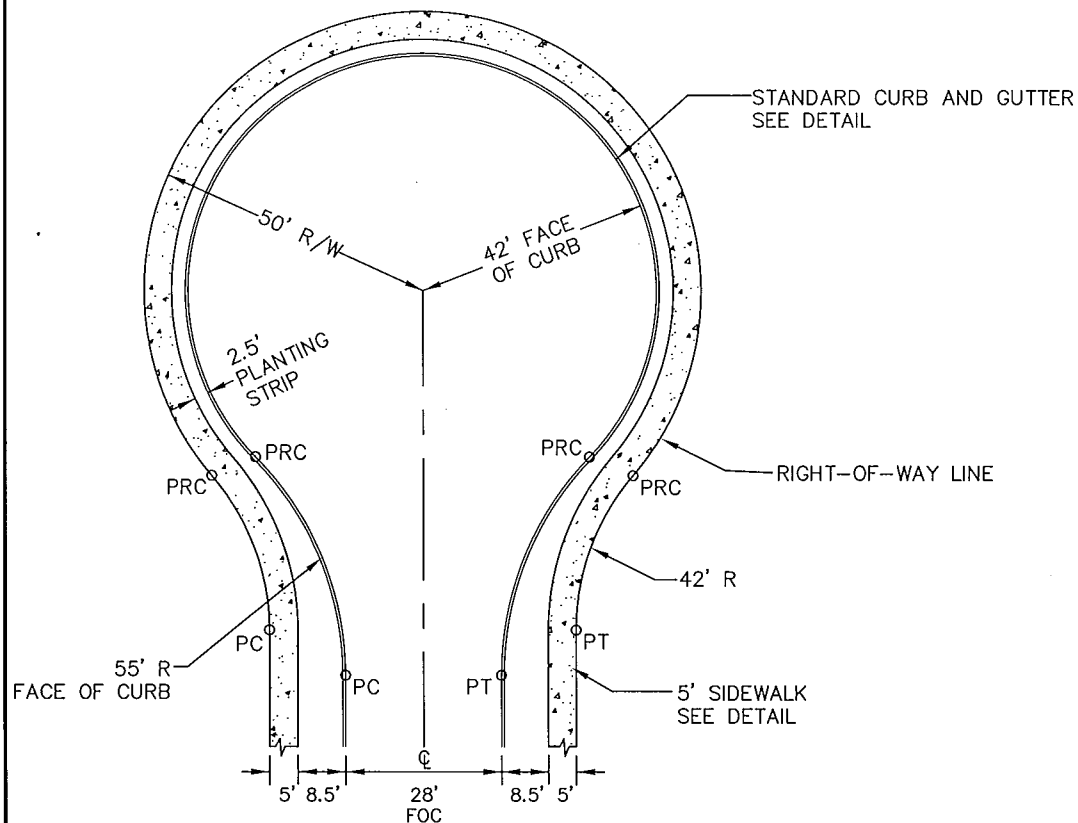
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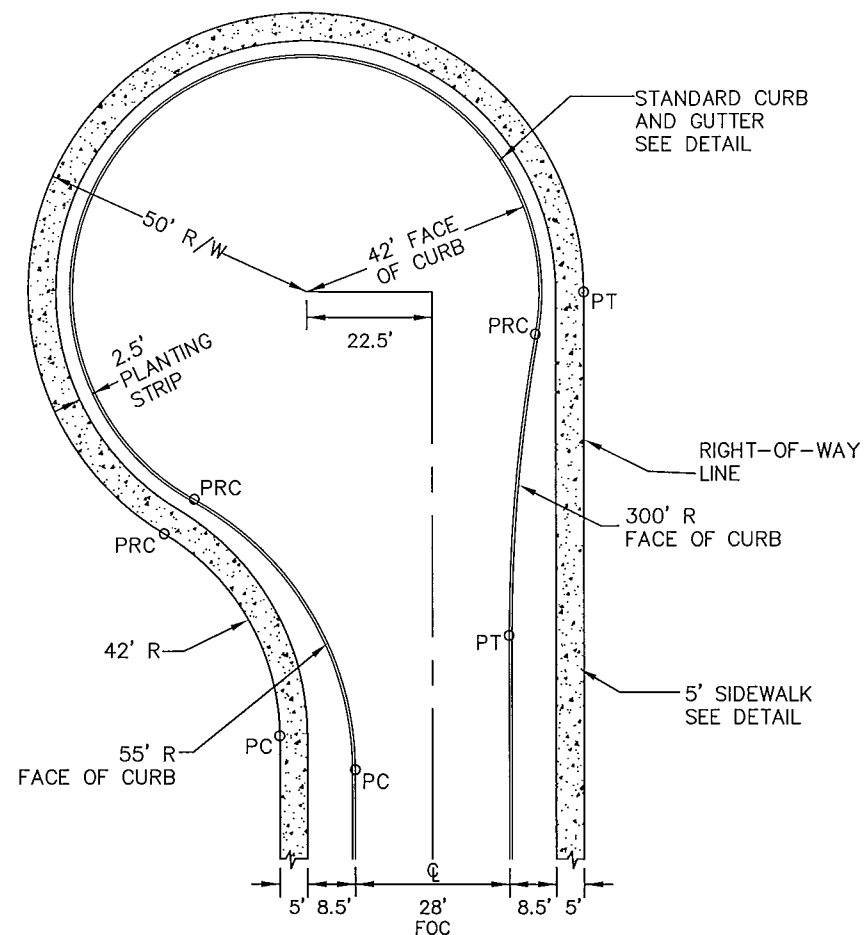


TYPICAL PAVEMENT SECTION

1. APPLICATION RATE FOR LAYING ANY HMA ON EXISTING PAVEMENTS SHALL BE 0.05 – 0.15 GAL PER SQUARE YARD
2. APPLICATION RATE FOR MACADAM AND RECYCLED PORTLAND CEMENT BASE COURSE SHALL BE 0.25 – 0.30 GAL PER SQUARE YARD



STANDARD CUL-DE-SAC



ASYMMETRICAL CUL-DE-SAC

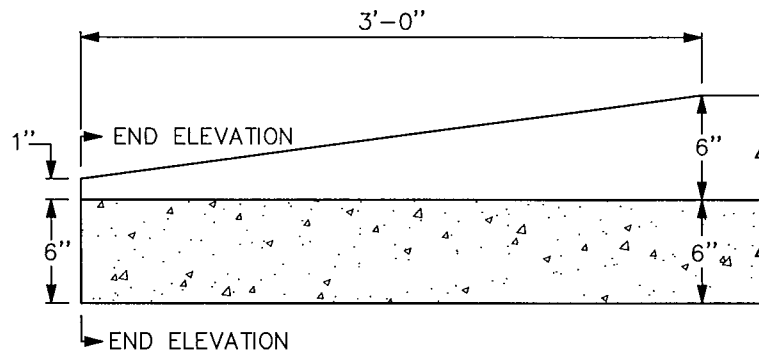
NOTE

1. ALTERNATIVE CUL-DE-SAC DESIGNS, INCLUDING THOSE WITH ISLANDS, SHALL BE SUBMITTED TO THE CITY ENGINEER FOR REVIEW AND APPROVAL.
2. WHEN A CENTER ISLAND IS PROPOSED, THE DESIGN ENGINEER SHALL APPLY A TURNING TEMPLATE USING THE APPROPRIATE DESIGN VEHICLE AND SHALL SUBMIT A PLAN CLEARLY SHOWING THE COMPLETE WHEEL PATH AROUND THE ISLAND.
2. THE PAVEMENT CROWN SHALL BE 1/4" PER FT FROM THE CENTER OF THE CUL-DE-SAC.
3. REFER TO CITY OF GREENVILLE STREET DESIGN MATRIX FOR APPLICABILITY.



DETAIL A

11:00

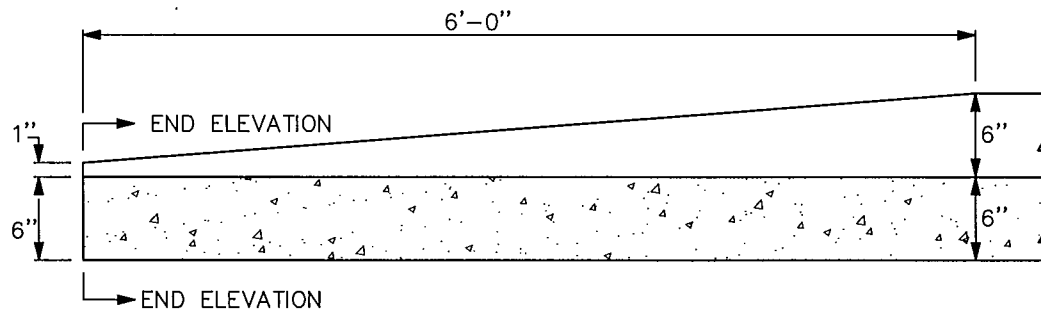


ELEVATION

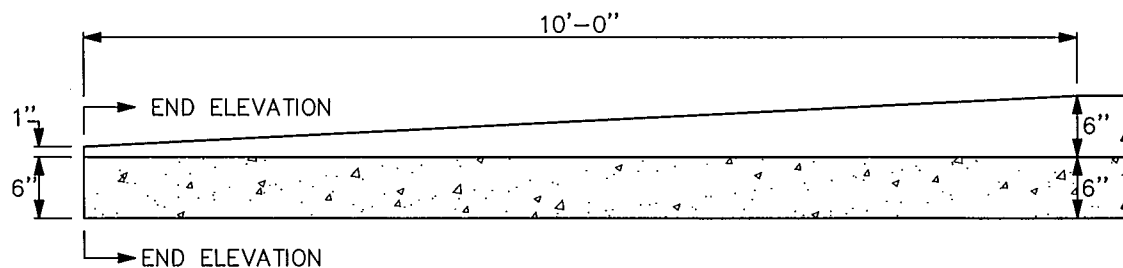
NOTE

1. USE 3.0' CURB END TAPER AT END OF RADII ON INTERSECTING STREETS AND WHERE CURB IS 6 FEET OR GREATER FROM MAINLINE TRAVEL LANE.

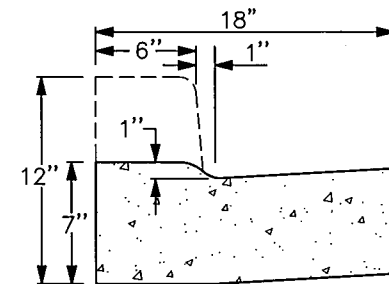
2. USE 10.0' CURB END TAPER AT END OF CURB WHERE CURB IS LESS THAN 6 FEET FROM MAINLINE TRAVEL LANE.



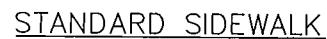
ELEVATION



ELEVATION



END ELEVATION

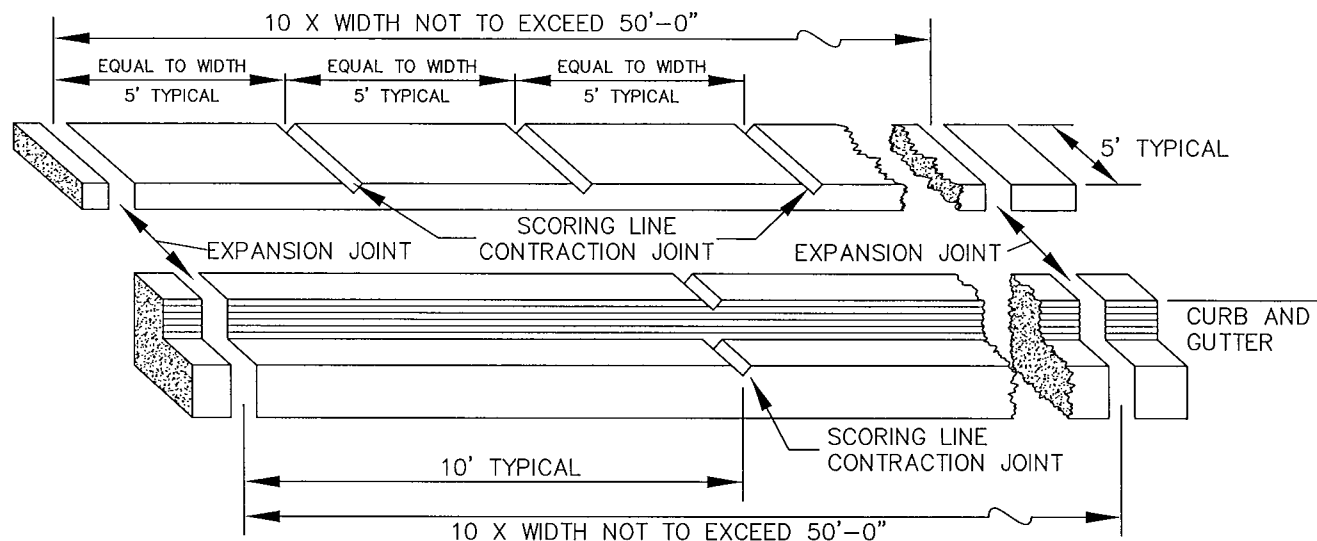


1. CONCRETE SHALL BE CDOT CLASS CLASS 3000 IN CONFORMANCE WITH THE APPLICABLE REQUIREMENTS OF SECTION 701 OF THE SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION. CONCRETE SHALL BE "READY MIX" HAVING A 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI AND BE AIR ENTRAINED.
2. SIDEWALK TO HAVE SCORING LINES (CONTRACTION JOINTS) AND EXPANSION JOINTS PER THE CITY OF GREENVILLE STANDARD DETAIL.
3. SIDEWALK SHALL BE CONSTRUCTED IN CONFORMANCE WITH THE APPLICABLE REQUIREMENTS OF SECTION 720.4 OF THE SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION. SURFACE SHALL RECEIVE A MEDIUM BROOM FINISH.
4. THE SUBGRADE SHALL BE THOROUGHLY COMPACTED TO 95 PERCENT OF THE STANDARD PROCTOR DENSITY AND FINISHED TO A SMOOTH, FIRM SURFACE AND SHALL BE MOIST AT THE TIME THE CONCRETE IS PLACED.
5. SIDEWALKS SHALL NOT CROSS DRIVEWAYS WITHOUT EXPRESS WRITTEN CONSENT OF THE CITY ENGINEER. TYPICALLY, THE CONTRACTOR SHALL INSTALL THE DRIVEWAY BEFORE THE SIDEWALK. IF INSTALLING THE DRIVEWAY AFTER THE SIDEWALK IS IN PLACE, THE CONTRACTOR SHALL SAW CUT AND REMOVE THE SIDEWALK FOR THE FULL WIDTH OF THE DRIVEWAY SECTION. SEE CITY OF GREENVILLE STANDARD DETAIL FOR DRIVEWAY CONSTRUCTION.
6. INTEGRAL CURB AND SIDEWALK IS NOT PERMISSIBLE FOR PUBLIC INFRASTRUCTURE.

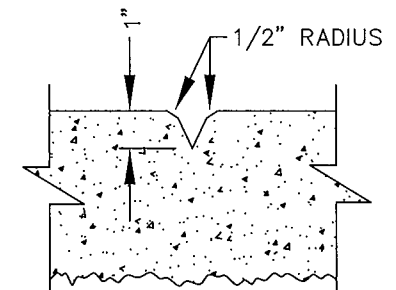
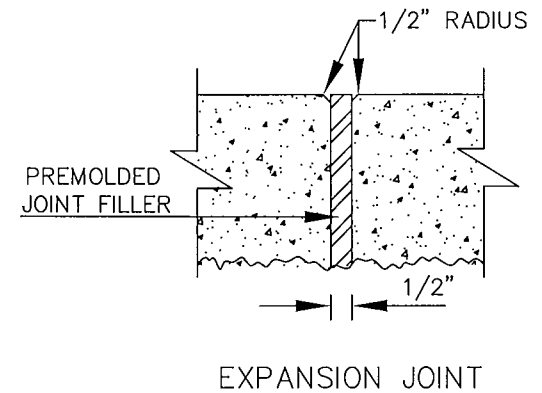


Philip B. Lindsey

11:02



ISOMETRIC



NOTE

1. ALL WORK TO BE COMPLETED IN ACCORDANCE WITH CITY OF GREENVILLE DETAILS AND SPECIFICATIONS. SIDEWALK AND CURBING PER CITY OF GREENVILLE DETAIL.
2. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION INSPECTION BUREAU AT LEAST 24 HOURS PRIOR TO PLACING CONCRETE. THE CITY WILL INSPECT SUBGRADE, FORMS, GRADE AND ALIGNMENT.
3. EXPANSION JOINTS, 1/2 INCH THICK, SHALL BE PLACED IN THE SIDEWALK AND CURBING AT THE POINT OF CURVATURE (PC) AND POINT OF TANGENCY (PT) OF ALL CURVES, AT THE OUTER EDGES OF DRIVEWAYS, AND AT UNIFORM INTERVALS AS SHOWN. EXPANSION JOINTS SHALL MEET SCDOT SPECIFICATION SECTION 702.2.2.1.
4. TRANSVERSE SCORING LINES (CONTRACTION JOINTS) IN THE SIDEWALK SHALL BE PLACED BETWEEN EXPANSION JOINTS AT UNIFORM INTERVALS EQUAL TO THE WIDTH OF THE WALK AS SHOWN.
5. LONGITUDINAL SCORING LINES WILL BE REQUIRED IN WALKS WIDER THAN 5 FEET OR AS DIRECTED BY THE CITY ENGINEER.
6. TRANSVERSE CONTRACTION JOINTS IN THE CURBING SHALL BE PLACED BETWEEN EXPANSION JOINTS AT UNIFORM 10' INTERVALS.
7. TRANSVERSE AND LONGITUDINAL SCORING LINES SHALL BE A DEPTH OF 1" AND NOT LESS THAN 1/4 INCH OR MORE THAN 1/2 INCH IN WIDTH. THE CORNERS OF THE SCORING LINES SHALL HAVE A 1/2 INCH MINIMUM RADIUS.
8. JOINTS IN THE CURB AND GUTTER SHALL ALIGN WITH CORRESPONDING JOINTS IN THE SIDEWALK.



**EXPANSION JOINTS AND
SCORING LINES**

DATE
APPROVED: **AUG. 2008**

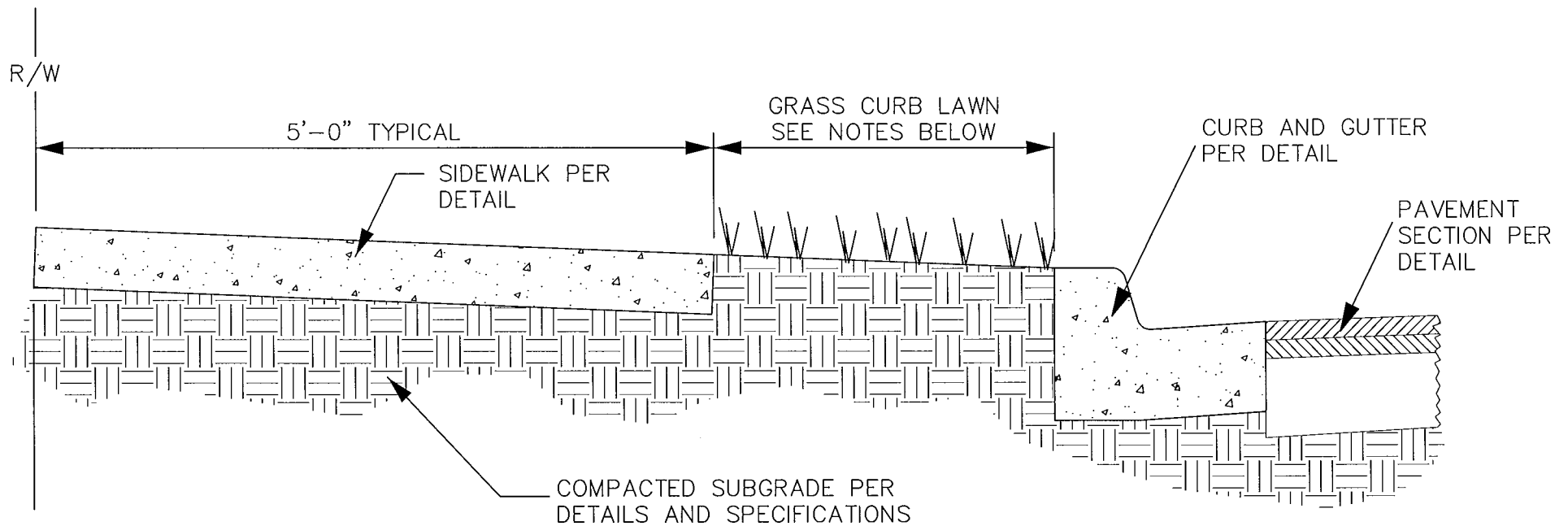
OFFICE OF THE
CITY ENGINEER:

Philip R. Lindsey

SCALE:
NO SCALE

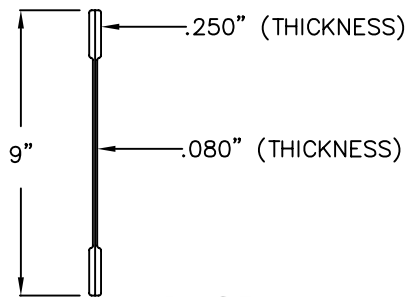
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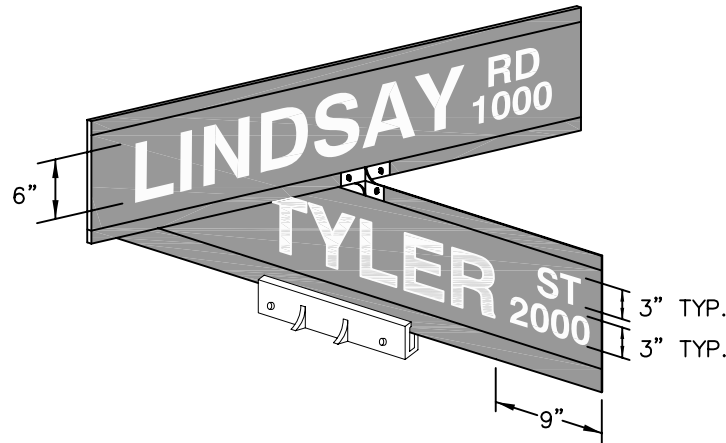


NOTE

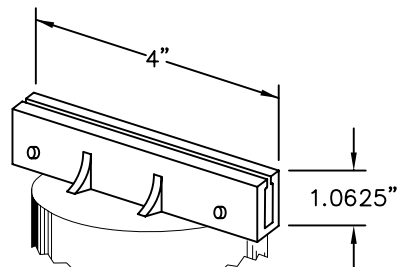
1. ALL SIDEWALK, CURB & GUTTER, GRASS CURB LAWN AND PAVEMENT SECTIONS SHALL BE CONSTRUCTED IN ACCORDANCE WITH CITY OF GREENVILLE DETAILS AND SPECIFICATIONS.
2. ALL NEW SIDEWALK SHALL BE CONSTRUCTED WITH A CURB LAWN. ALL EXISTING SIDEWALK SHALL BE BROUGHT INTO CONFORMANCE WITH THIS DETAIL.
3. ON NEW STREETS, THE MINIMUM CURB LAWN WIDTH SHALL BE IN ACCORDANCE WITH THE APPLICABLE STREET SECTION.
4. ALONG THE FRONTAGE OF EXISTING STREETS, THE MINIMUM CURB LAWN WIDTH SHALL BE IN ACCORDANCE WITH THE PREVAILING LAWN WIDTH OR THE WIDTH ASSOCIATED WITH THE STREET CLASSIFICATION, AT THE DISCRETION OF THE CITY ENGINEER. IN RESTRICTED CONDITIONS, THE MINIMUM CURB LAWN WIDTH SHALL BE 2'-6".



BLADE

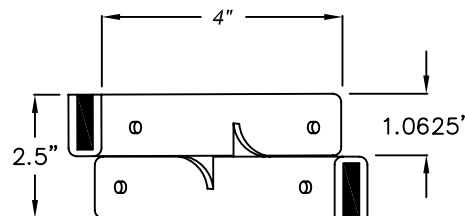


TYPICAL LETTERING



CAP TYPE AND STYLE
DEPENDENT ON POST.

CAP WITH BLADE BRACKET



BLADE SPACER BRACKET

NOTE

1. ALL STREET NAME SIGNS ARE SUBJECT TO APPROVAL BY THE CITY ENGINEER.
2. BLADES SHALL BE .080" THICK EXTRUDED ALUMINUM 6063T5 OR 6063T6 ALLOY WITH A THICKENED EDGE.
3. CAP SHALL BE DIE CAST AND POLISHED ALUMINUM #380 ALLOY, OR APPROVED EQUAL, SLOTTED FOR .25" EXTRUDED BLADE. CAP SHALL BE TAPPED TO RECEIVE AND INCLUDE 2 STAINLESS STEEL SET SCREWS FOR BLADE MOUNTING. SET SCREWS TO HAVE ALLEN HEADS.
4. BLADE SPACER BRACKET SHALL MEET SAME SPECIFICATIONS AS THE CAP WITH 2 SCREWS TO EACH BLADE MOUNTING.
5. THE FACE OF ALL BLADES SHALL MEET RETROREFLECTIVITY REQUIREMENTS TO SHOW THE SAME SHAPE AND SIMILAR COLOR BOTH DAY AND NIGHT. THE LEGEND AND BACKGROUND SHALL BE OF CONTRASTING COLORS. CITY OF GREENVILLE SIGNS SHOULD HAVE WHITE LETTERS ON A GREEN BACKGROUND.
6. PRIMARY LETTERS SHALL BE 6" HIGH UPPER CASE, FHWA SERIES B AND PREFIX/SUFFIX LETTERS SHALL BE 3" HIGH, UPPER CASE, FHWA SERIES C. FOR LOCAL ROADS WITH SPEED LIMITS OF 25 MPH OR LESS, A 6" BLADE WITH 4" HIGH PRIMARY LETTERS MAY BE USED WITH APPROVAL OF THE CITY ENGINEER.
7. BLOCK NUMBERS MAY BE PROVIDED ON SIGNS AND SHALL CORRESPOND TO OFFICIALLY APPROVED ADDRESSES. IF PROVIDED, BLOCK NUMBERS SHALL BE PLACED IN THE LOWER RIGHT CORNER AND SHALL BE 3" HIGH, FHWA SERIES C.
8. ALL MATERIALS TO BE APPLIED TO A PREPARED ALUMINUM BLADE THAT HAS BEEN CLEANED AND ALL FOREIGN MATERIAL REMOVED.
9. LETTERS, NUMBERS AND SPACING SHALL CONFORM TO THE LATEST EDITION OF THE STANDARD HIGHWAY SIGNS BOOK AND THE LATEST EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.
10. ALL STREET NAME SIGNS SHALL BE INSTALLED PER THE SPECIFICATIONS OF THE LATEST EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES. LOCATIONS ARE TO BE APPROVED BY THE CITY ENGINEER PRIOR TO INSTALLATION.

1. THE WIDTH AND SHAPE OF THE MEDIAN SHALL BE DESIGNATED ON THE PLANS.

2. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION INSPECTION BUREAU AT LEAST 24 HOURS PRIOR TO PLACING CONCRETE. THE CITY WILL INSPECT BASE, FORMS, GRADE AND ALIGNMENT.

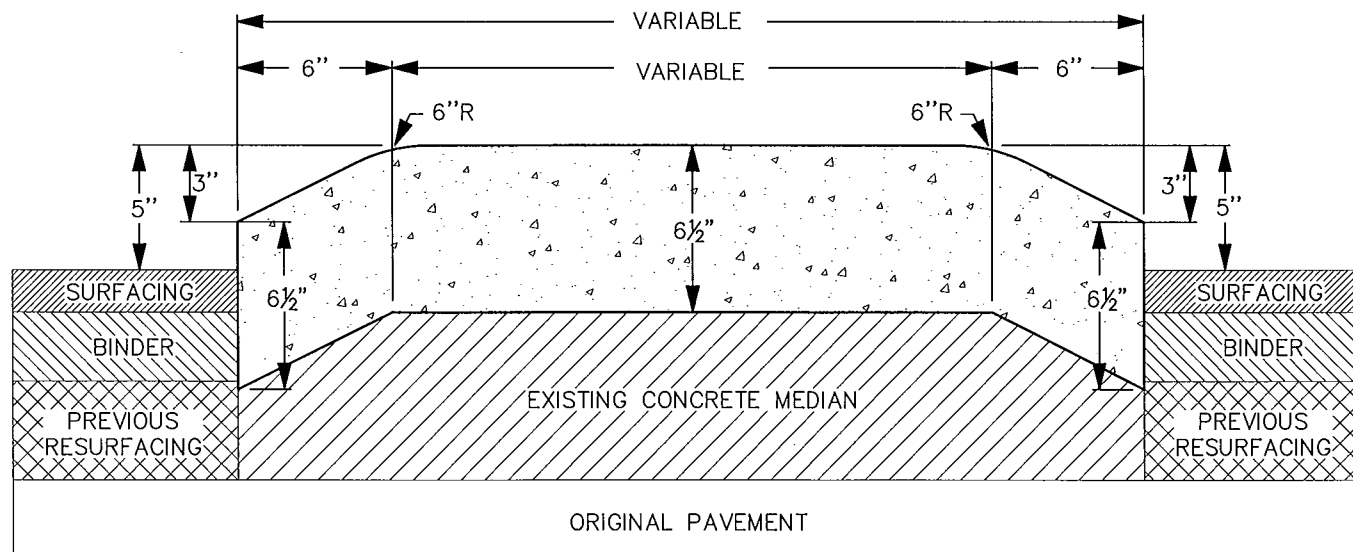
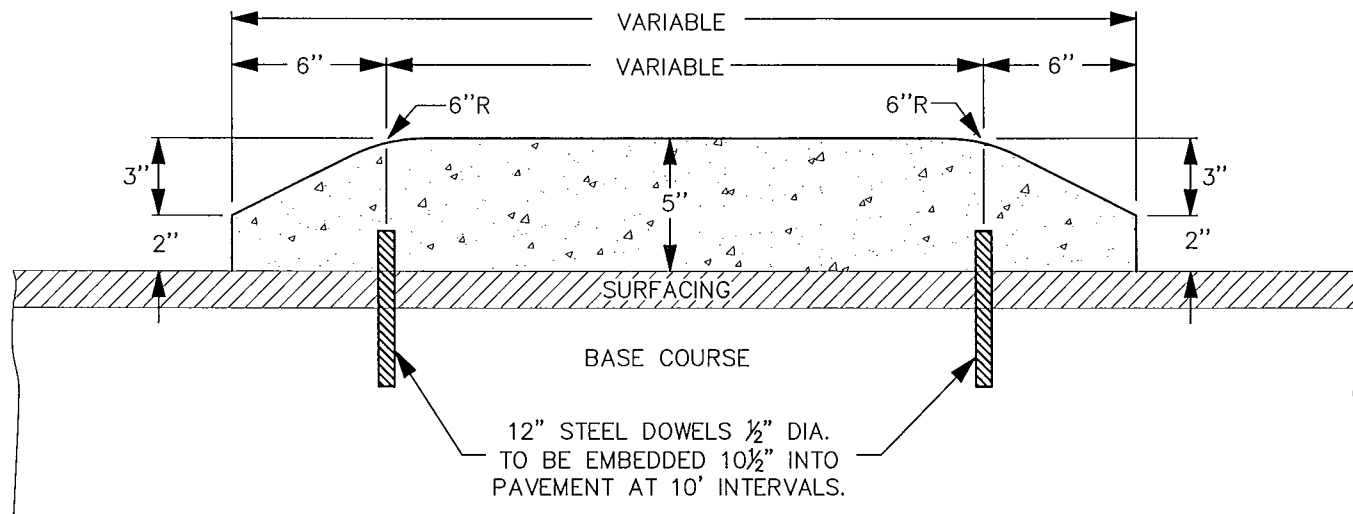
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4. CONCRETE MEDIAN SHALL BE CONSTRUCTED IN CONFORMANCE WITH THE APPLICABLE REQUIREMENTS OF SECTION 720.4 OF THE SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION. SURFACE SHALL RECEIVE A MEDIUM BROOM FINISH.

5. EXPANSION JOINTS, 1/2 INCH THICK, SHALL BE PLACED IN THE MEDIAN ADJACENT TO EXISTING OR NEW PAVEMENT & STRUCTURES AND AT UNIFORM INTERVALS OF NOT MORE THAN 50 FEET. EXPANSION JOINTS SHALL MEET SCDOT SPECIFICATION SECTION 702.2.2.1.

6. TRANSVERSE SCORING LINES
(CONTRACTION JOINTS) IN THE MEDIAN
SHALL BE PLACED BETWEEN EXPANSION
JOINTS AT UNIFORM INTERVALS OF NOT
MORE THAN 25 FEET.

7. CONTRACTION JOINTS SHALL BE AT A DEPTH OF NOT LESS THAN A QUARTER OF THE MEDIAN DEPTH (1¼" TYPICAL) AND NOT LESS THAN ¼ INCH OR MORE THAN ½ INCH IN WIDTH. THE CORNERS OF THE SCORING LINES SHALL HAVE A ½ INCH MINIMUM RADIUS.



CONCRETE MEDIAN

DATE APPROVED: **AUG. 2008**

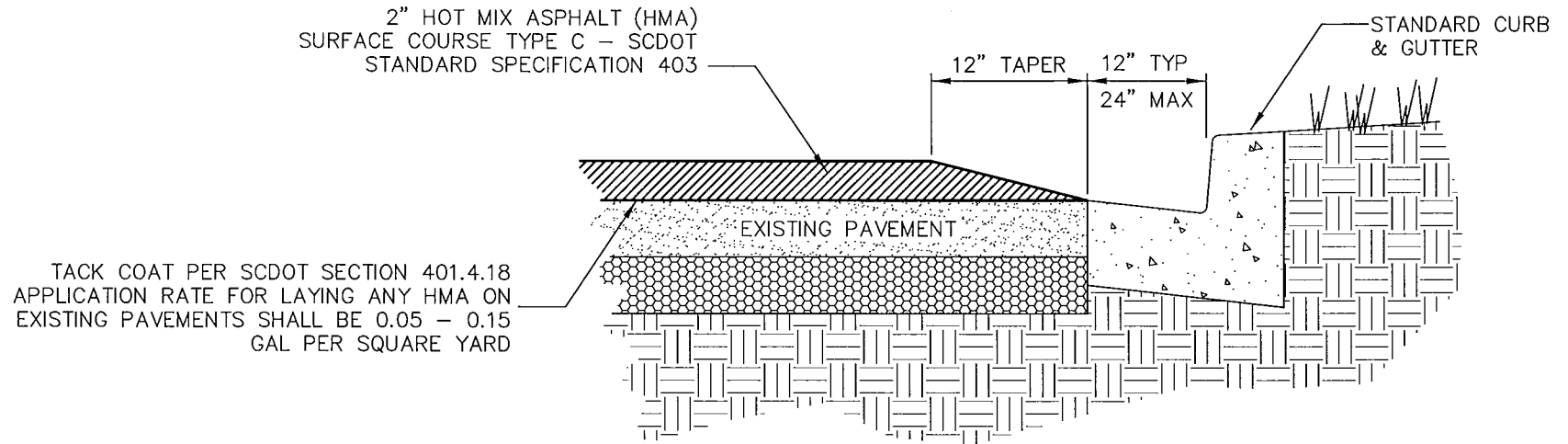
OFFICE OF THE
CITY ENGINEER:

Philip B. Lindsay

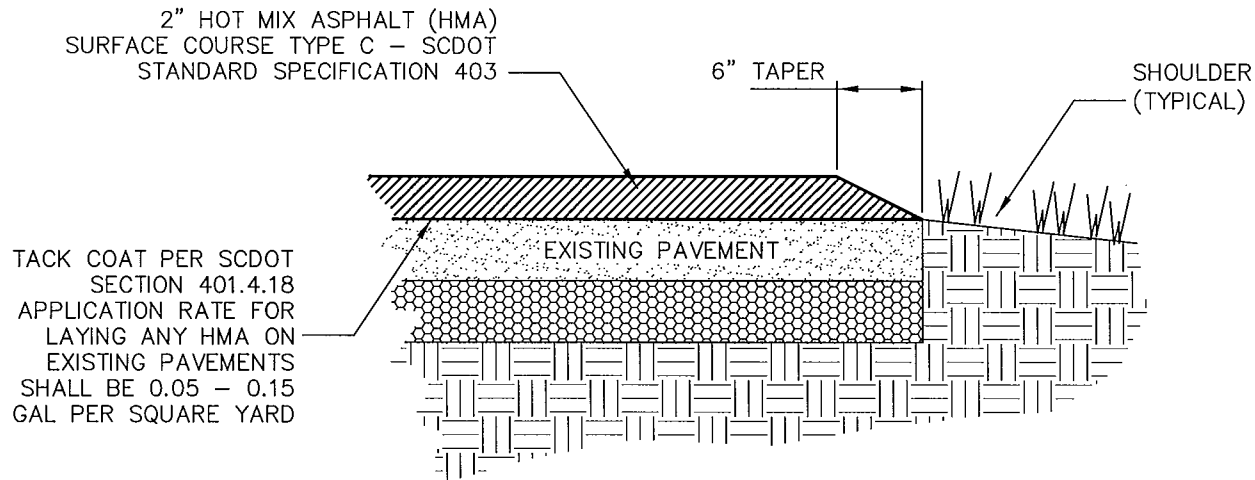
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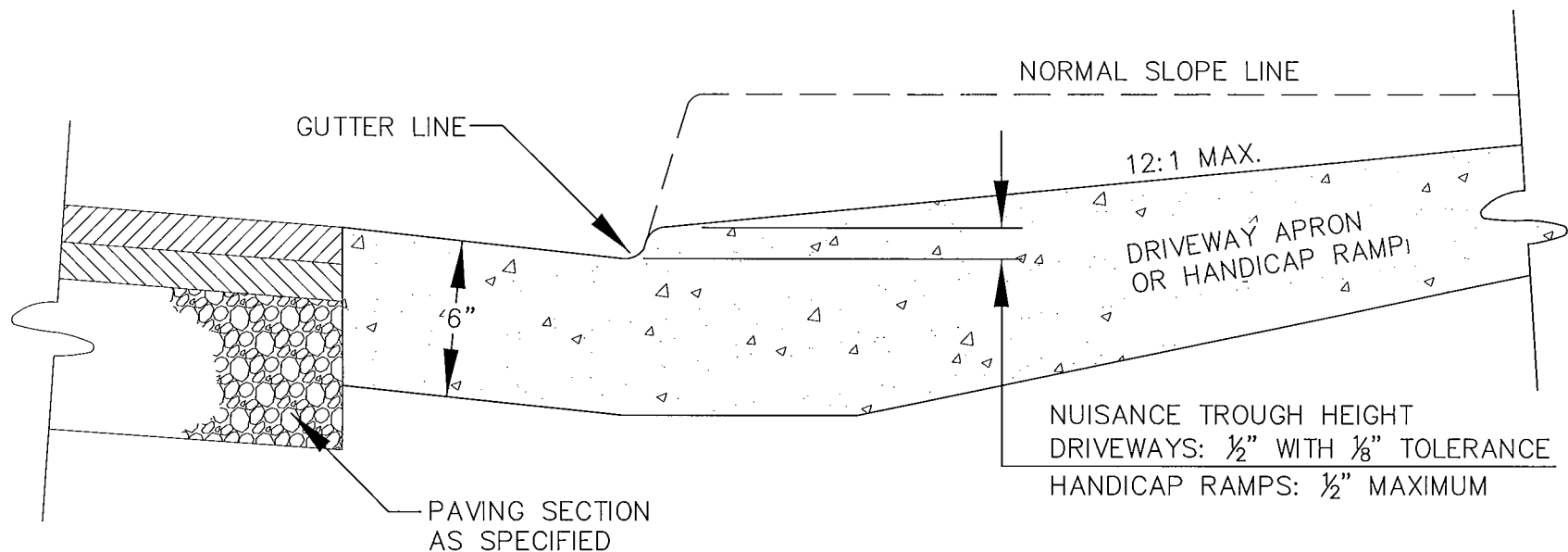
SECTION B-B: TYPICAL EDGE TREATMENT



SECTION B-B: ALTERNATE EDGE TREATMENT FOR STREETS WITHOUT
CURB & GUTTER

NOTE

1. ALL SIGNAGE AND PAVEMENT MARKINGS SHALL MEET MUTCD REGULATIONS AND MUST BE APPROVED BY THE CITY ENGINEER PRIOR TO INSTALLATION.
2. ALTERNATE PAVING MATERIALS MUST BE APPROVED BY THE CITY ENGINEER PRIOR TO INSTALLATION.



NOTE

1. INSTALLATION OF NUISANCE TROUGH ONLY WHEN DIRECTED BY CITY ENGINEER.
2. ON HANDICAP RAMPS, VERTICAL DISCONTINUITIES BETWEEN $\frac{1}{4}$ " AND $\frac{1}{2}$ " MAXIMUM SHALL BE BEVELED AT 2:1 MINIMUM. THE BEVEL SHALL BE APPLIED ACROSS THE ENTIRE LEVEL CHANGE.
3. DRIVEWAY APRON AND HANDICAP RAMP PER CITY OF GREENVILLE DETAIL.
4. CONCRETE SHALL BE SCDOT CLASS 3000 IN CONFORMANCE WITH THE APPLICABLE REQUIREMENTS OF SECTION 701 OF THE SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION. CONCRETE SHALL BE "READY MIX" HAVING A 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI AND BE AIR ENTRAINED.

NOTE

1. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION INSPECTION BUREAU AT LEAST 24 HOURS PRIOR TO PLACING CONCRETE. THE CITY WILL INSPECT SUBGRADE, FORMS, GRADE AND ALIGNMENT.

2. DRIVEWAYS TO BE CONSTRUCTED WHERE APPROVED BY THE CITY ENGINEER.

3. DRIVEWAY WIDTH (W) SHALL BE:
ONE WAY DRIVE: 12' TO 16'
TWO WAY DRIVE: 20' TO 40'

4. DRIVEWAY SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF SECTION 720.4 OF THE SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION. DRIVE SURFACE SHALL RECEIVE A MEDIUM BROOM FINISH.

5. DRIVEWAY TO HAVE SCORING LINES (CONTRACTION JOINTS) AND 1/2" EXPANSION JOINTS WHERE SHOWN.

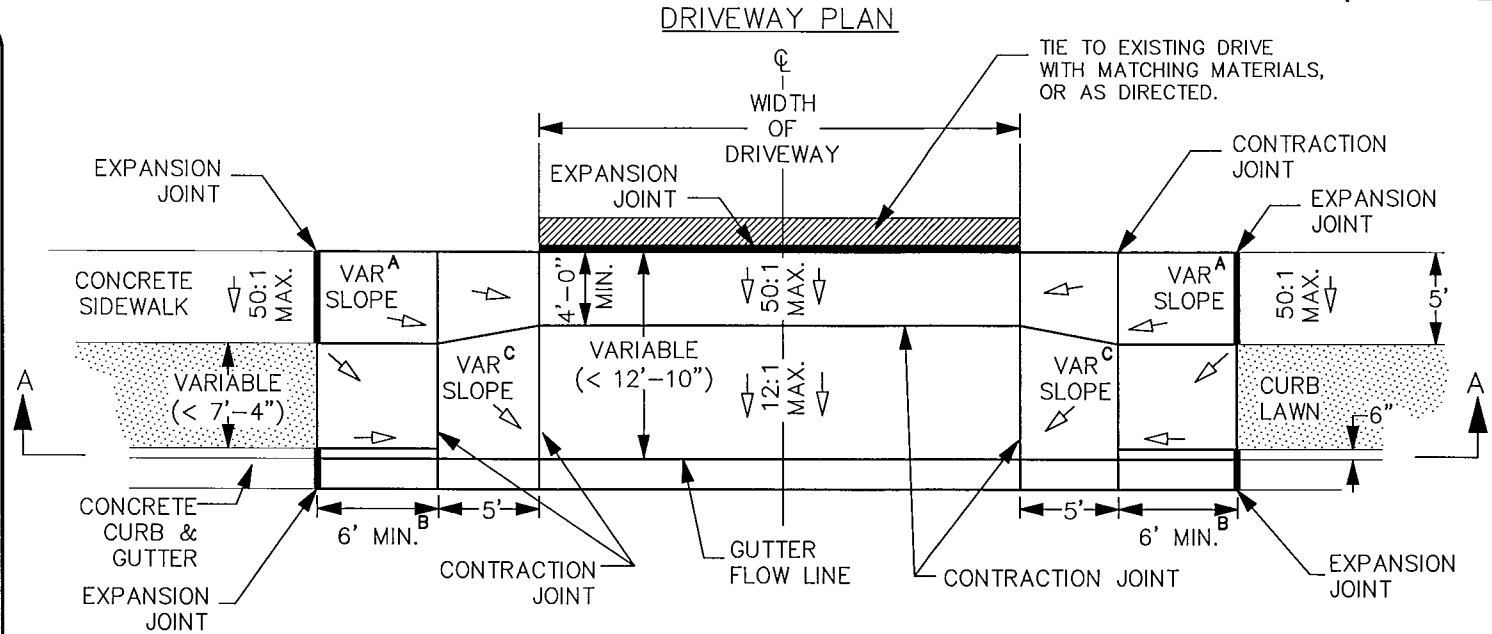
6. WHERE THE WIDTH OF A DRIVEWAY IS 15' OR GREATER, A CONTRACTION JOINT SHALL BE PLACED IN THE CENTER OF THE DRIVE. IF THE WIDTH EXCEEDS 30 FEET, TWO (2) UNIFORMLY SPACED JOINTS SHALL BE USED.

7. EXPANSION JOINTS SHALL MEET SCDOT SPECIFICATION SECTION 702.2.2.1. TRANSVERSE AND LONGITUDINAL CONTRACTION JOINTS SHALL BE A DEPTH OF 1" AND NOT LESS THAN 1/4" OR MORE THAN 1/2" IN WIDTH. THE CORNERS OF THE SCORING LINES SHALL HAVE A 1/2 INCH MINIMUM RADII.

8. WHERE ANY PORTION OF THE ADJACENT ROADWAY MUST BE RECONSTRUCTED, ROADWAY SURFACE SHALL BE SAWCUT STRAIGHT AND SMOOTH TO A DEPTH OF NO LESS THAN 2". THE ENTIRE SECTION SHALL BE REMOVED AND PATCHED AS DIRECTED BY THE CITY ENGINEER. IF THE REMOVED SECTION IS LESS THAN 12" IN WIDTH, CONCRETE SHALL BE USED AS A BASE COURSE AND THEN CAPPED WITH A 2" ASPHALT OVERLAY.

9. SIDEWALK AND CURB REPLACEMENT PER CITY OF GREENVILLE DETAILS.

10. GUTTER LINE TYPICALLY INSTALLED WITH SMOOTH TRANSITION AS SHOWN. INSTALLATION OF A NUISANCE TROUGH, PER STANDARD DETAIL, MAY BE REQUIRED AT THE DIRECTION OF THE CITY ENGINEER.



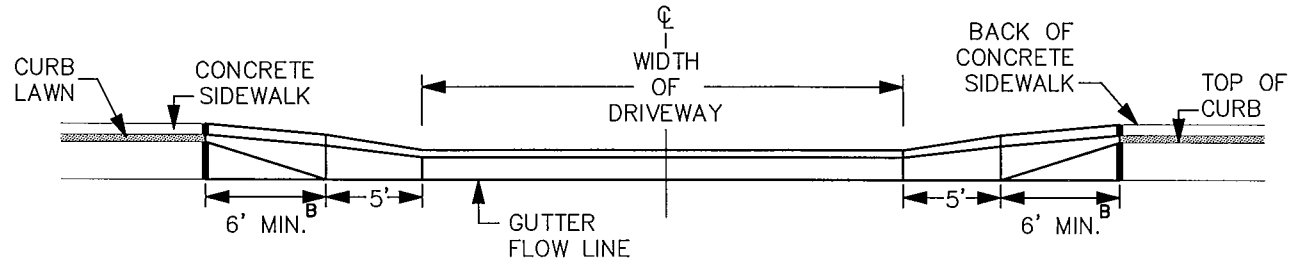
FOOTNOTES:

A. SIDEWALKS ARE TO BE CONSTRUCTED ON A 50:1 MAX. CROSS SLOPE. THE SIDE SLOPES OF THE RAMP ARE NOT TO EXCEED 12:1 AT ANY LOCATION WHERE PEDESTRIAN TRAFFIC CROSSES THE RAMP.

B. 6' MINIMUM LENGTH ONLY APPLIES IF THE CURB LINE IS ON A 0% GRADE. LENGTH OF TAPER WILL VARY BY THE SLOPE OF THE ROADWAY. MAXIMUM SLOPE OF CURB TAPER SHALL BE 12:1.

C. THE FLARED SLOPE IN THE SIDEWALK ON EITHER SIDE OF THE DRIVEWAY MAY REQUIRE MODIFICATION DUE TO ELEVATION DIFFERENCES BETWEEN THE CURB AND THE SIDEWALK. MAXIMUM SLOPE SHALL BE 12:1.

SECTION A-A



ENGINEERING DIVISION

COMMERCIAL DRIVEWAY I CURB LAWN LESS THAN 7'-4"

DATE APPROVED: AUG. 2008

OFFICE OF THE CITY ENGINEER:

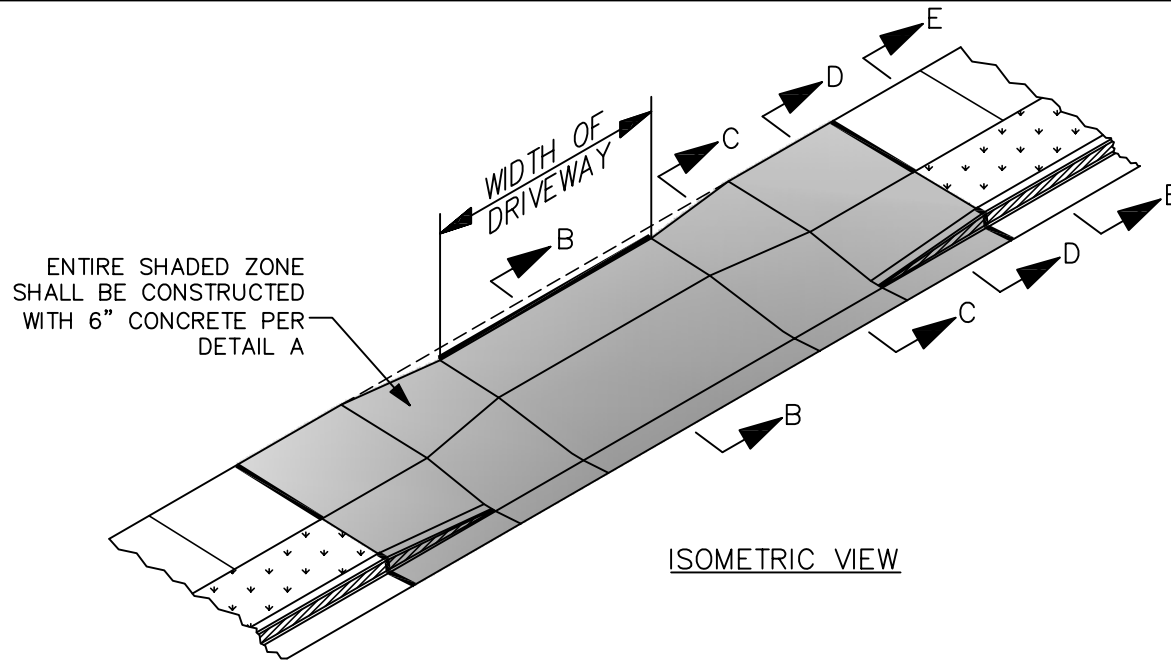
Philip B. Lindsey

SCALE:
NO SCALE

DETAIL:

13:00

SHEET 1 OF 2

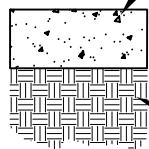


ISOMETRIC VIEW

6" CONCRETE APRON

1. CONCRETE SHALL BE SCDOT CLASS 3000 IN CONFORMANCE WITH THE APPLICABLE REQUIREMENTS OF SECTION 701 OF THE SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION. CONCRETE SHALL BE "READY MIX" HAVING A 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI AND BE AIR ENTRAINED.

2. DRIVEWAY APRON SHALL BE POURED MONOLITHICALLY FROM BACK OF SIDEWALK TO FACE OF GUTTER.



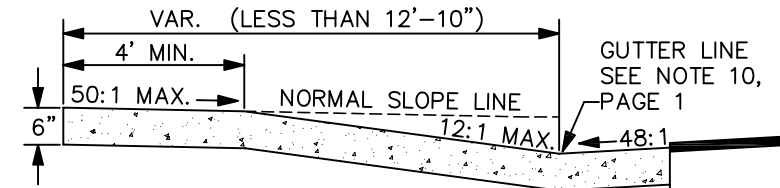
DETAIL A

SUBGRADE

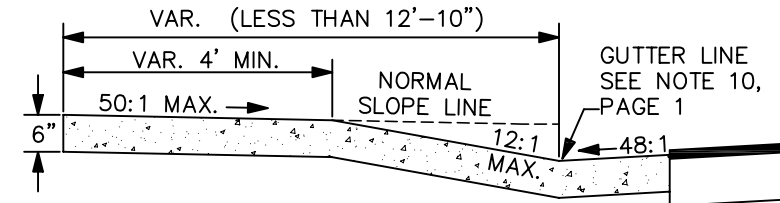
1. THE SUBGRADE SHALL BE THOROUGHLY COMPACTED TO 95 PERCENT OF THE STANDARD PROCTOR DENSITY, FINISHED TO A SMOOTH, FIRM SURFACE, AND SHALL BE MOIST AT THE TIME THE CONCRETE IS PLACED.

2. THE CONTRACTOR SHALL UNDERCUT AND REPLACE UNSUITABLE SOIL WITH COMPACTED AGGREGATE BASE COURSE MEETING SCDOT STANDARD SPECIFICATION 305.

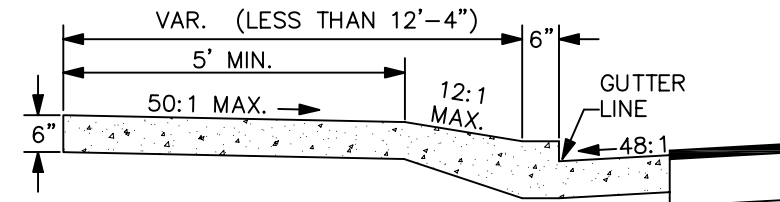
SECTION B-B



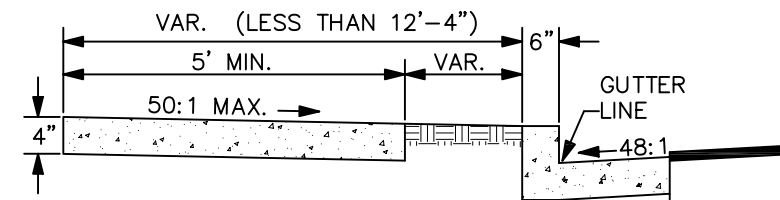
SECTION C-C



SECTION D-D



SECTION E-E



NOTE

1. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION INSPECTION BUREAU AT LEAST 24 HOURS PRIOR TO PLACING CONCRETE. THE CITY WILL INSPECT SUBGRADE, FORMS, GRADE AND ALIGNMENT.

2. DRIVEWAYS TO BE CONSTRUCTED WHERE APPROVED BY THE CITY ENGINEER.

3. DRIVEWAY WIDTH (W) SHALL BE:
ONE WAY DRIVE: 12' TO 16'
TWO WAY DRIVE: 20' TO 40'

4. DRIVEWAY SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF SECTION 720.4 OF THE SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION. DRIVE SURFACE SHALL RECEIVE A MEDIUM BROOM FINISH.

5. DRIVEWAY TO HAVE SCORING LINES (CONTRACTION JOINTS) AND $\frac{1}{2}$ " EXPANSION JOINTS WHERE SHOWN.

6. WHERE THE WIDTH OF A DRIVEWAY IS 15' OR GREATER, A CONTRACTION JOINT SHALL BE PLACED IN THE CENTER OF THE DRIVE. IF THE WIDTH EXCEEDS 30 FEET, TWO (2) UNIFORMLY SPACED JOINTS SHALL BE USED.

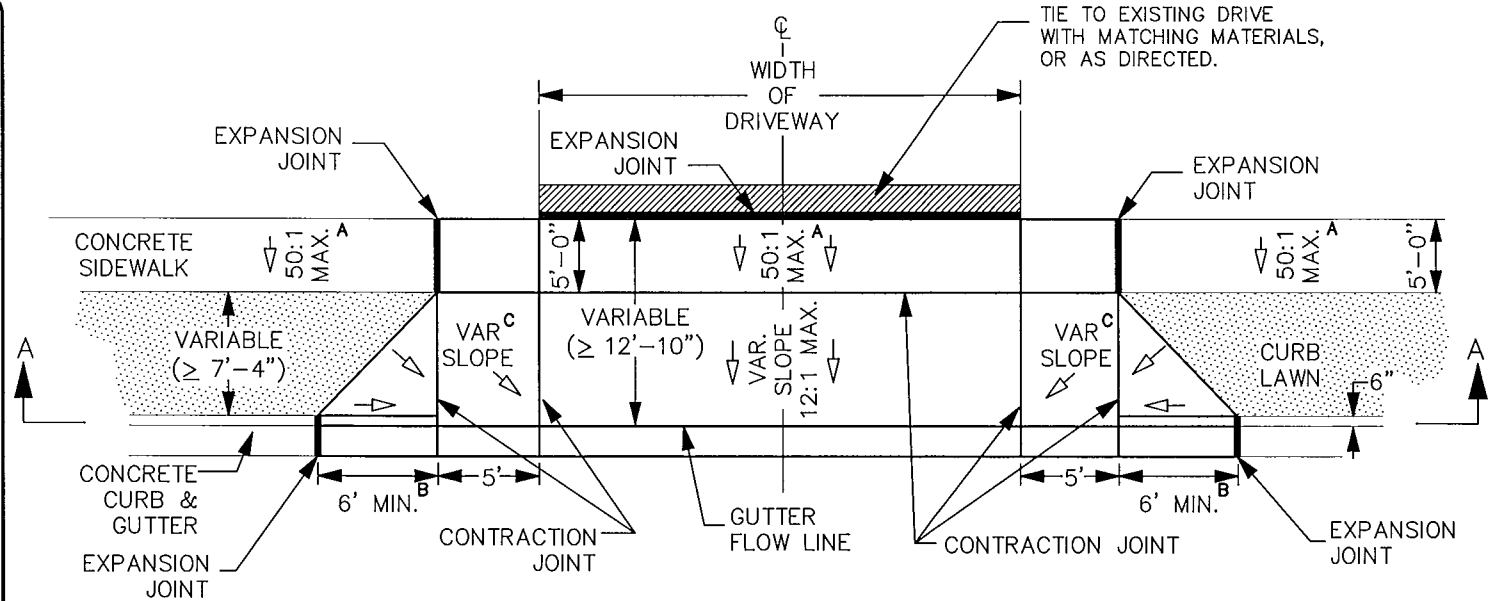
7. EXPANSION JOINTS SHALL MEET SCDOT SPECIFICATION SECTION 702.2.2.1. TRANSVERSE AND LONGITUDINAL CONTRACTION JOINTS SHALL BE A DEPTH OF 1" AND NOT LESS THAN $\frac{1}{4}$ " OR MORE THAN $\frac{1}{2}$ " IN WIDTH. THE CORNERS OF THE SCORING LINES SHALL HAVE A $\frac{1}{2}$ INCH MINIMUM RADII.

8. WHERE ANY PORTION OF THE ADJACENT ROADWAY MUST BE RECONSTRUCTED, ROADWAY SURFACE SHALL BE SAWCUT STRAIGHT AND SMOOTH TO A DEPTH OF NO LESS THAN 2". THE ENTIRE SECTION SHALL BE REMOVED AND PATCHED AS DIRECTED BY THE CITY ENGINEER. IF THE REMOVED SECTION IS LESS THAN 12" IN WIDTH, CONCRETE SHALL BE USED AS A BASE COURSE AND THEN CAPPED WITH A 2" ASPHALT OVERLAY.

9. SIDEWALK AND CURB REPLACEMENT PER CITY OF GREENVILLE DETAILS.

10. GUTTER LINE TYPICALLY INSTALLED WITH SMOOTH TRANSITION AS SHOWN. INSTALLATION OF A NUISANCE TROUGH, PER STANDARD DETAIL, MAY BE REQUIRED AT THE DIRECTION OF THE CITY ENGINEER.

DRIVEWAY PLAN



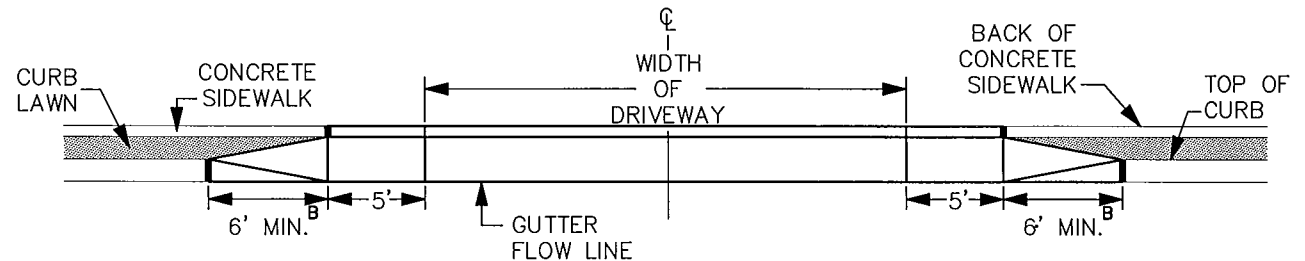
FOOTNOTES:

A. SIDEWALKS ARE TO BE CONSTRUCTED ON A 50:1 MAX. CROSS SLOPE. IT SHOULD NOT BE NECESSARY TO RAMP THE SIDEWALK AT THE DRIVE. IN NO CASE SHALL THE SIDE SLOPES OF A RAMP EXCEED 12:1 AT ANY LOCATION WHERE PEDESTRIAN TRAFFIC CROSSES THE RAMP.

B. 6' MINIMUM LENGTH ONLY APPLIES IF THE CURB LINE IS ON A 0% GRADE. LENGTH OF TAPER WILL VARY BY THE SLOPE OF THE ROADWAY. MAXIMUM SLOPE OF CURB TAPER SHALL BE 12:1.

C. THE FLARED SLOPE IN THE SIDEWALK ON EITHER SIDE OF THE DRIVEWAY MAY REQUIRE MODIFICATION DUE TO ELEVATION DIFFERENCES BETWEEN THE CURB AND THE SIDEWALK. MAXIMUM SLOPE SHALL BE 12:1.

SECTION A-A



 city of
greenville
ENGINEERING DIVISION

COMMERCIAL DRIVEWAY II CURB LAWN 7'-4" OR GREATER

DATE
APPROVED: AUG. 2008

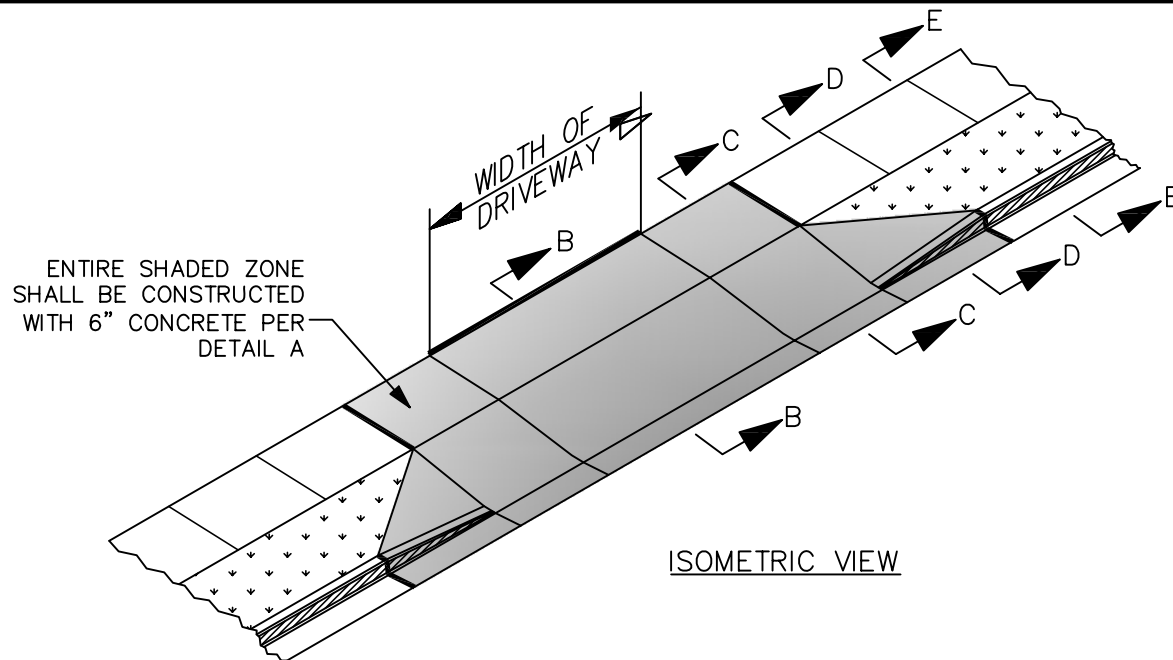
OFFICE OF THE
CITY ENGINEER:

Philip B. Lindsey

SCALE:
NO SCALE

DETAIL :

13:01
SHEET 1 OF 2

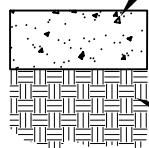


ISOMETRIC VIEW

6" CONCRETE APRON

1. CONCRETE SHALL BE SCDOT CLASS 3000 IN CONFORMANCE WITH THE APPLICABLE REQUIREMENTS OF SCDOT SECTION 701 OF THE SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION. CONCRETE SHALL BE "READY MIX" HAVING A 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI AND BE AIR ENTRAINED.

2. DRIVEWAY APRON SHALL BE POURED MONOLITHICALLY FROM BACK OF SIDEWALK TO FACE OF GUTTER.



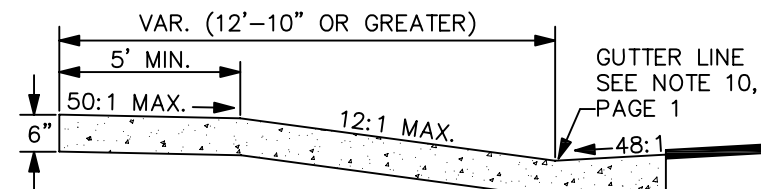
DETAIL A

SUBGRADE

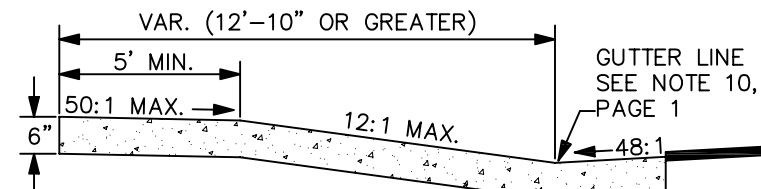
1. THE SUBGRADE SHALL BE THOROUGHLY COMPACTED TO 95 PERCENT OF THE STANDARD PROCTOR DENSITY, FINISHED TO A SMOOTH, FIRM SURFACE, AND SHALL BE MOIST AT THE TIME THE CONCRETE IS PLACED.

2. THE CONTRACTOR SHALL UNDERCUT AND REPLACE UNSUITABLE SOIL WITH COMPACTED AGGREGATE BASE COURSE MEETING SCDOT STANDARD SPECIFICATION 305.

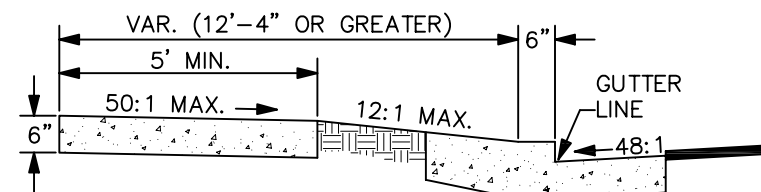
SECTION B-B



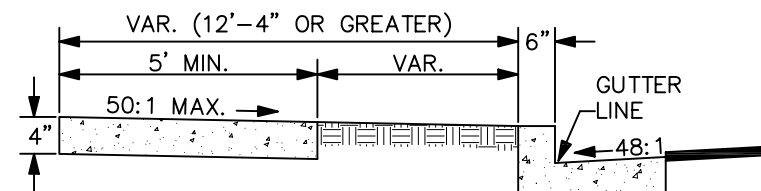
SECTION C-C



SECTION D-D



SECTION E-E



NOTE

1. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION INSPECTION BUREAU AT LEAST 24 HOURS PRIOR TO PLACING CONCRETE. THE CITY WILL INSPECT SUBGRADE, FORMS, GRADE AND ALIGNMENT.

2. DRIVEWAYS TO BE CONSTRUCTED WHERE APPROVED BY THE CITY ENGINEER.

3. DRIVEWAY WIDTH (W) SHALL BE 10' MIN. TO 24' MAX.

4. DRIVEWAY SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF SECTION 720.4 OF THE SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION. DRIVE SURFACE SHALL RECEIVE A MEDIUM BROOM FINISH.

5. DRIVEWAY TO HAVE SCORING LINES (CONTRACTION JOINTS) AND 1/2" EXPANSION JOINTS WHERE SHOWN.

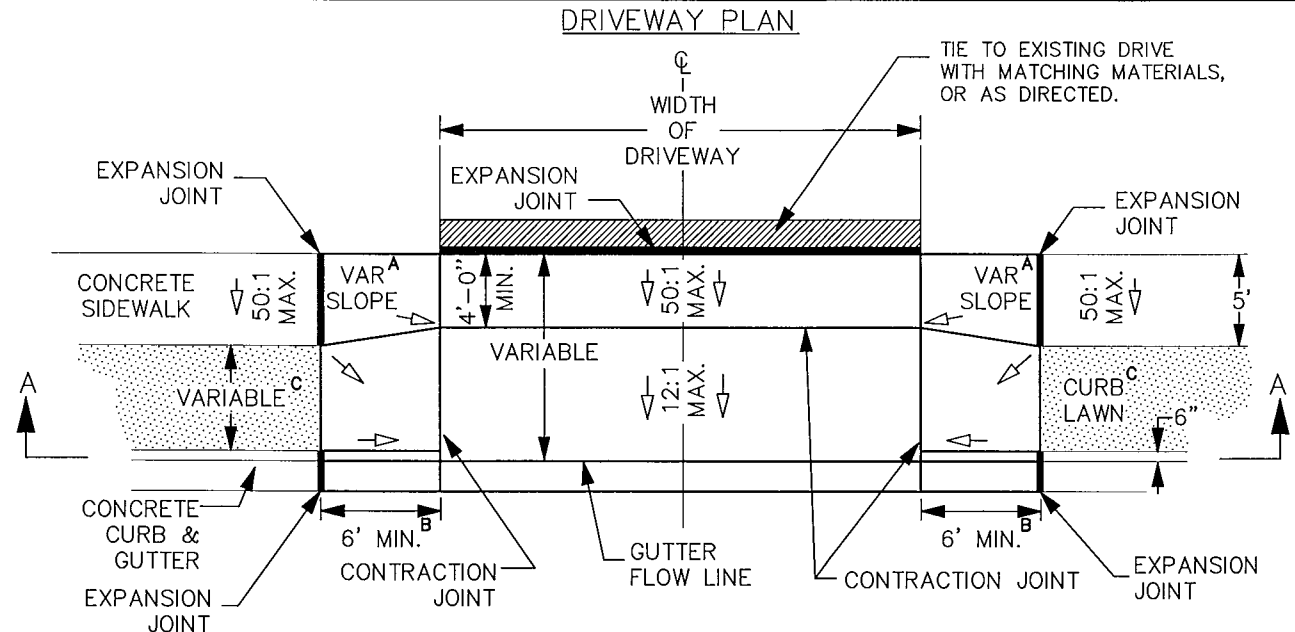
6. WHERE THE WIDTH OF A DRIVEWAY IS 15' OR GREATER, A CONTRACTION JOINT SHALL BE PLACED IN THE CENTER OF THE DRIVE. IF THE WIDTH EXCEEDS 30 FEET, TWO (2) UNIFORMLY SPACED JOINTS SHALL BE USED.

7. EXPANSION JOINTS SHALL MEET SCDOT SPECIFICATION SECTION 702.2.2.1. TRANSVERSE AND LONGITUDINAL CONTRACTION JOINTS SHALL BE A DEPTH OF 1" AND NOT LESS THAN 1/4" OR MORE THAN 1/2" IN WIDTH. THE CORNERS OF THE SCORING LINES SHALL HAVE A 1/2 INCH MINIMUM RADIUS.

8. WHERE ANY PORTION OF THE ADJACENT ROADWAY MUST BE RECONSTRUCTED, ROADWAY SURFACE SHALL BE SAWCUT STRAIGHT AND SMOOTH TO A DEPTH OF NO LESS THAN 2". THE ENTIRE SECTION SHALL BE REMOVED AND PATCHED AS DIRECTED BY THE CITY ENGINEER. IF THE REMOVED SECTION IS LESS THAN 12" IN WIDTH, CONCRETE SHALL BE USED AS A BASE COURSE AND THEN CAPPED WITH A 2" ASPHALT OVERLAY.

9. SIDEWALK AND CURB REPLACEMENT PER CITY OF GREENVILLE DETAILS.

10. GUTTER LINE TYPICALLY INSTALLED WITH SMOOTH TRANSITION AS SHOWN. INSTALLATION OF A NUISANCE TROUGH, PER STANDARD DETAIL, MAY BE REQUIRED AT THE DIRECTION OF THE CITY ENGINEER.



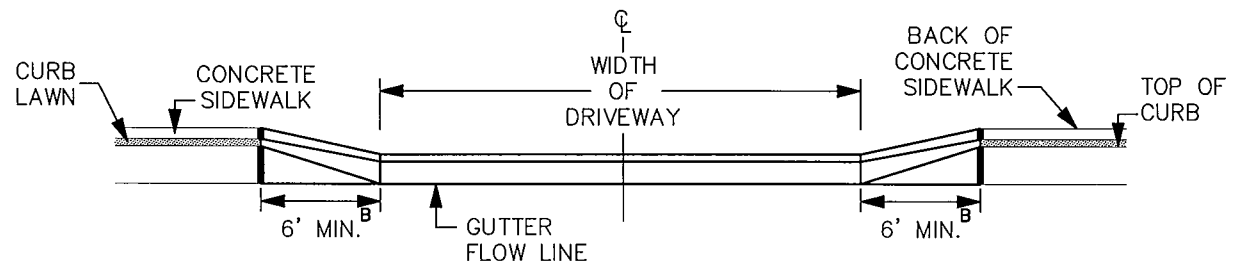
FOOTNOTES:

A. SIDEWALKS ARE TO BE CONSTRUCTED ON A 50:1 MAX. CROSS SLOPE. THE SIDE SLOPES OF THE RAMP ARE NOT TO EXCEED 12:1 AT ANY LOCATION WHERE PEDESTRIAN TRAFFIC CROSSES THE RAMP.

B. 6' MINIMUM LENGTH ONLY APPLIES IF THE CURB LINE IS ON A 0% GRADE. LENGTH OF TAPER WILL VARY BY THE SLOPE OF THE ROADWAY. MAXIMUM SLOPE OF CURB TAPER SHALL BE 12:1.

C. ON NEW STREETS, THE MINIMUM CURB LAWN WIDTH SHALL BE IN ACCORDANCE WITH THE APPLICABLE STREET SECTION. ALONG THE FRONTAGE OF EXISTING STREETS, THE MINIMUM CURB LAWN WIDTH SHALL BE IN ACCORDANCE WITH THE PREVAILING LAWN WIDTH OR THE WIDTH ASSOCIATED WITH THE STREET CLASSIFICATION, AT THE DISCRETION OF THE CITY ENGINEER. IN RESTRICTED CONDITIONS, THE MINIMUM CURB LAWN WIDTH SHALL BE 2'-6".

SECTION A-A



ENGINEERING DIVISION

RESIDENTIAL DRIVEWAY

DATE APPROVED: AUG. 2008

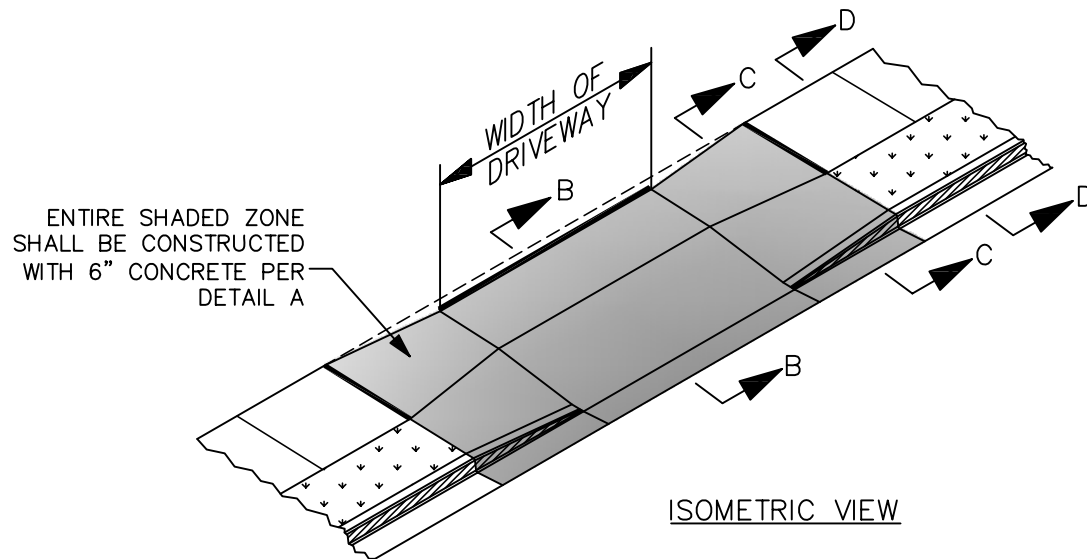
OFFICE OF THE CITY ENGINEER:

Philip B. Lindsey

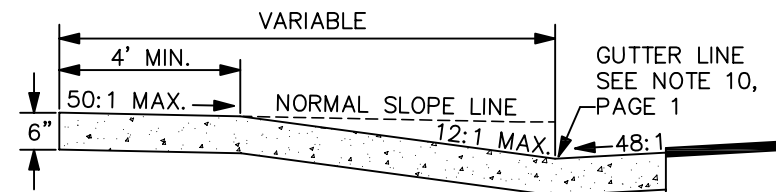
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DETAIL :

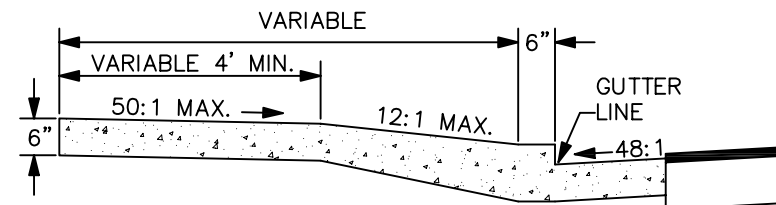
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SHEET 1 OF 2



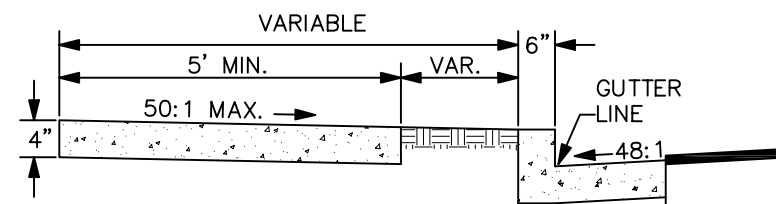
SECTION B-B



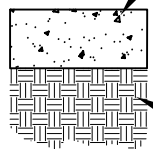
SECTION C-C



SECTION D-D

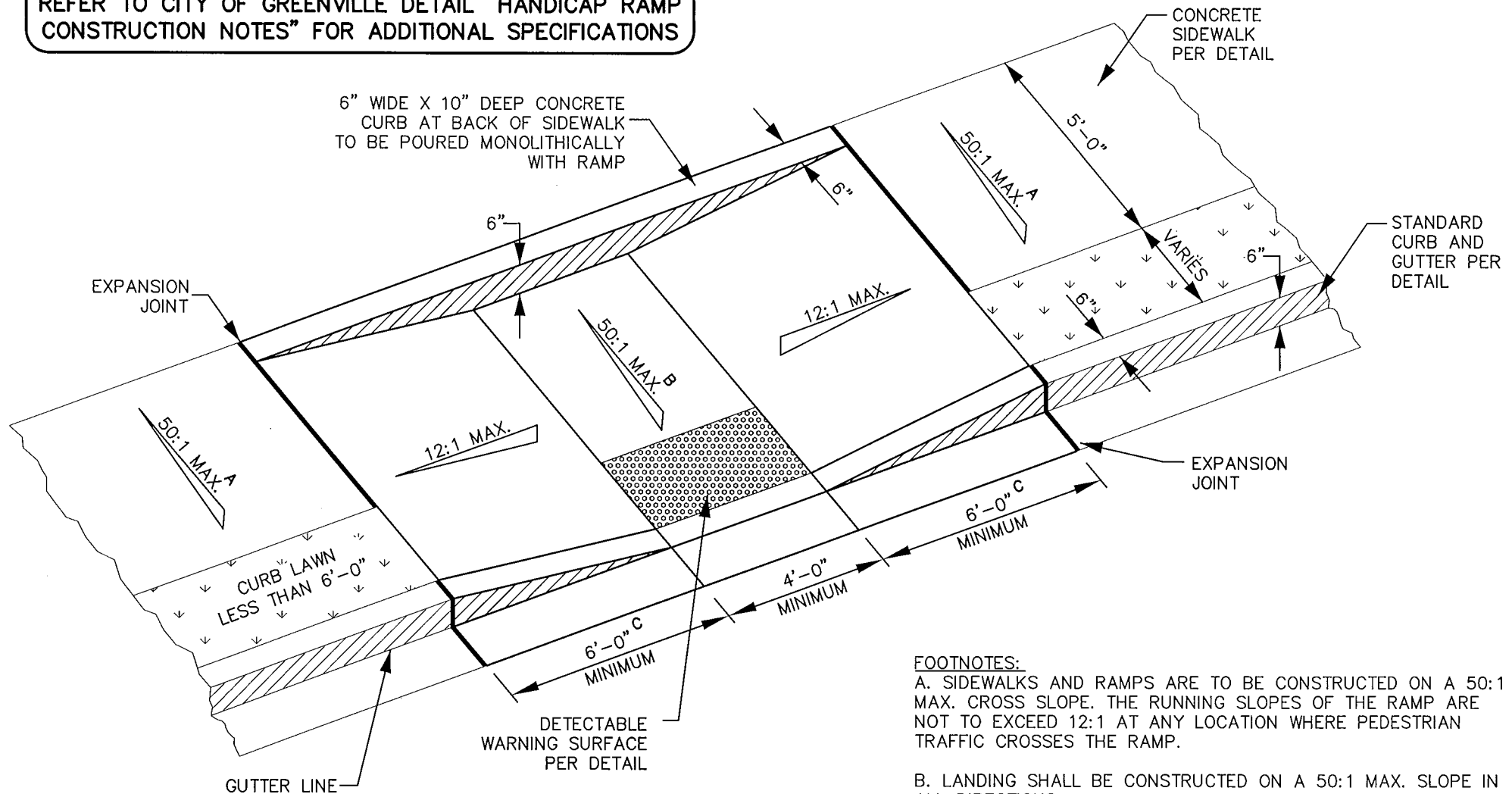


- 6" CONCRETE APRON**
1. CONCRETE SHALL BE SCDOT CLASS 3000 IN CONFORMANCE WITH THE APPLICABLE REQUIREMENTS OF SECTION 701 OF THE SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION. CONCRETE SHALL BE "READY MIX" HAVING A 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI AND BE AIR ENTRAINED.
 2. DRIVEWAY APRON SHALL BE POURED MONOLITHICALLY FROM BACK OF SIDEWALK TO FACE OF GUTTER.
- SUBGRADE**
1. THE SUBGRADE SHALL BE THOROUGHLY COMPACTED TO 95 PERCENT OF THE STANDARD PROCTOR DENSITY, FINISHED TO A SMOOTH, FIRM SURFACE, AND SHALL BE MOIST AT THE TIME THE CONCRETE IS PLACED.
 2. THE CONTRACTOR SHALL UNDERCUT AND REPLACE UNSUITABLE SOIL WITH COMPACTED AGGREGATE BASE COURSE MEETING SCDOT STANDARD SPECIFICATION 305.



DETAIL A

REFER TO CITY OF GREENVILLE DETAIL "HANDICAP RAMP
CONSTRUCTION NOTES" FOR ADDITIONAL SPECIFICATIONS



FOOTNOTES:

A. SIDEWALKS AND RAMPS ARE TO BE CONSTRUCTED ON A 50:1 MAX. CROSS SLOPE. THE RUNNING SLOPES OF THE RAMP ARE NOT TO EXCEED 12:1 AT ANY LOCATION WHERE PEDESTRIAN TRAFFIC CROSSES THE RAMP.

B. LANDING SHALL BE CONSTRUCTED ON A 50:1 MAX. SLOPE IN ALL DIRECTIONS.

C. 6' MINIMUM LENGTH ONLY APPLIES IF THE CURB LINE IS ON A 0% GRADE. LENGTH OF TAPER WILL VARY BY THE SLOPE OF THE ROADWAY. MAXIMUM SLOPE OF CURB TAPER SHALL BE 12:1.

 city of
greenville
ENGINEERING DIVISION

HANDICAP RAMP I CURB LAWN LESS THAN 6'-0"

DATE
APPROVED: AUG. 2008

OFFICE OF THE
CITY ENGINEER:

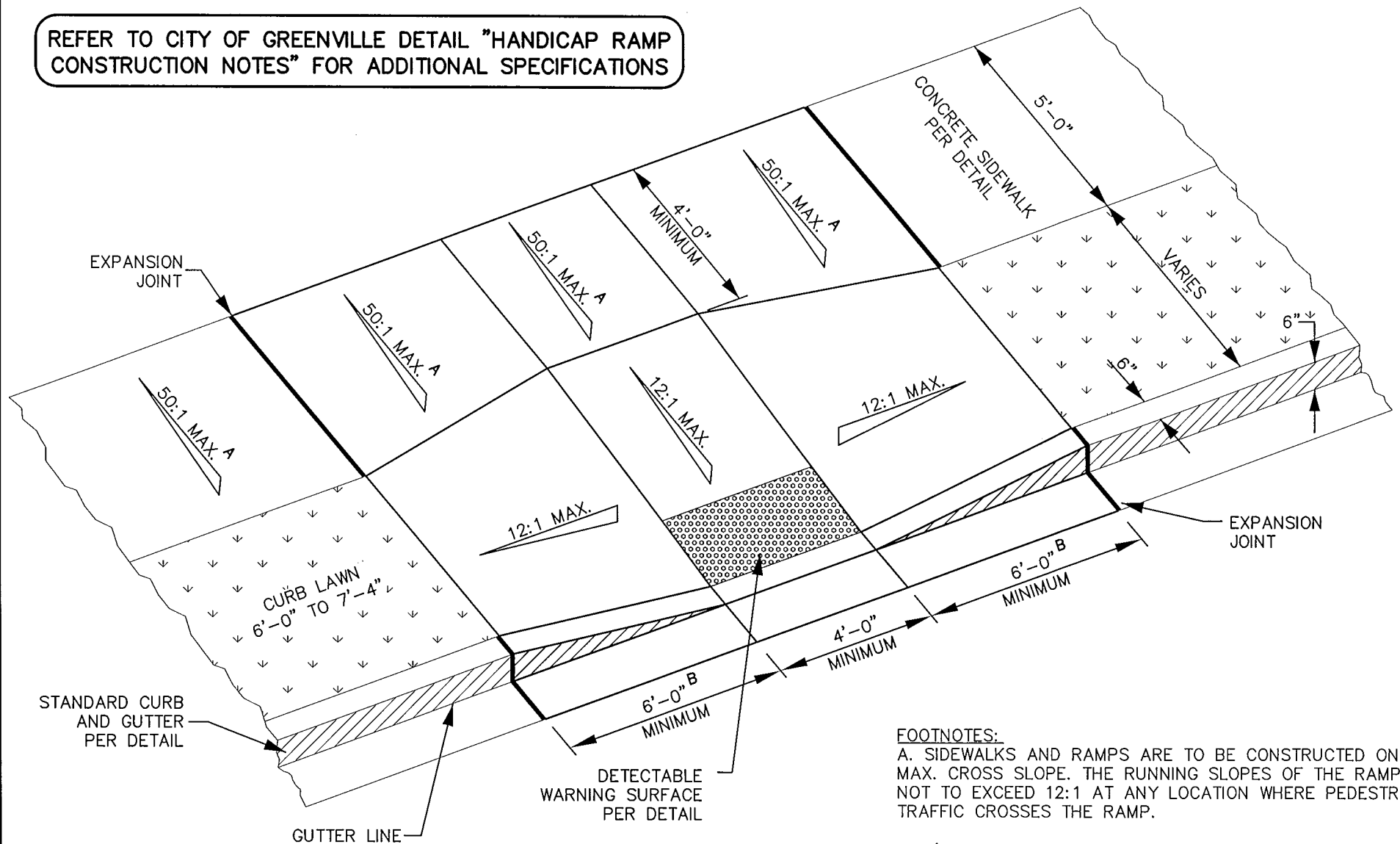
Philip B. Lindsey

SCALE:
NO SCALE

DETAIL:

14:00

REFER TO CITY OF GREENVILLE DETAIL "HANDICAP RAMP
CONSTRUCTION NOTES" FOR ADDITIONAL SPECIFICATIONS



FOOTNOTES:

A. SIDEWALKS AND RAMPS ARE TO BE CONSTRUCTED ON A 50:1 MAX. CROSS SLOPE. THE RUNNING SLOPES OF THE RAMP ARE NOT TO EXCEED 12:1 AT ANY LOCATION WHERE PEDESTRIAN TRAFFIC CROSSES THE RAMP.

B. 6' MINIMUM LENGTH ONLY APPLIES IF THE CURB LINE IS ON A 0% GRADE. LENGTH OF TAPER WILL VARY BY THE SLOPE OF THE ROADWAY. MAXIMUM SLOPE OF CURB TAPER SHALL BE 12:1.

 city of
greenville
ENGINEERING DIVISION

HANDICAP RAMP II
CURB LAWN 6'-0" TO 7'-4"

DATE
APPROVED: AUG. 2008

OFFICE OF THE
CITY ENGINEER:

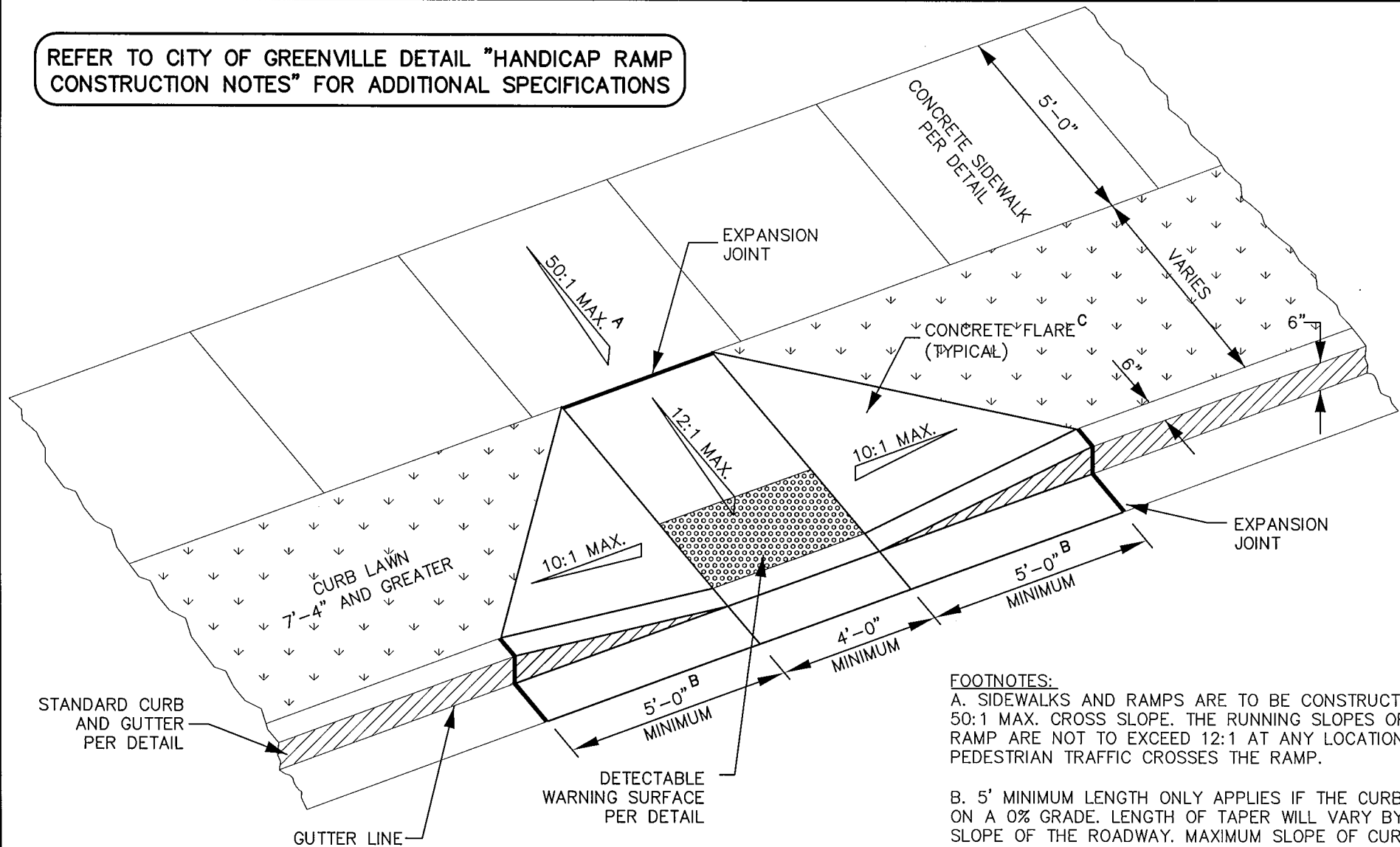
Philip B. Lindsey

SCALE:
NO SCALE

DETAIL :

14:01

REFER TO CITY OF GREENVILLE DETAIL "HANDICAP RAMP
CONSTRUCTION NOTES" FOR ADDITIONAL SPECIFICATIONS



FOOTNOTES:

A. SIDEWALKS AND RAMPS ARE TO BE CONSTRUCTED ON A 50:1 MAX. CROSS SLOPE. THE RUNNING SLOPES OF THE RAMP ARE NOT TO EXCEED 12:1 AT ANY LOCATION WHERE PEDESTRIAN TRAFFIC CROSSES THE RAMP.

B. 5' MINIMUM LENGTH ONLY APPLIES IF THE CURB LINE IS ON A 0% GRADE. LENGTH OF TAPER WILL VARY BY THE SLOPE OF THE ROADWAY. MAXIMUM SLOPE OF CURB TAPER MAY BE 10:1 WHERE NO PEDESTRIAN TRAFFIC OCCURS.

C. CONCRETE FLARE MAY BE OMITTED UPON APPROVAL BY THE CITY ENGINEER.

 city of
greenville
ENGINEERING DIVISION

HANDICAP RAMP III CURB LAWN 7'-4" & GREATER

DATE APPROVED: AUG. 2008

OFFICE OF THE
CITY ENGINEER:

Philip R. Lindsey

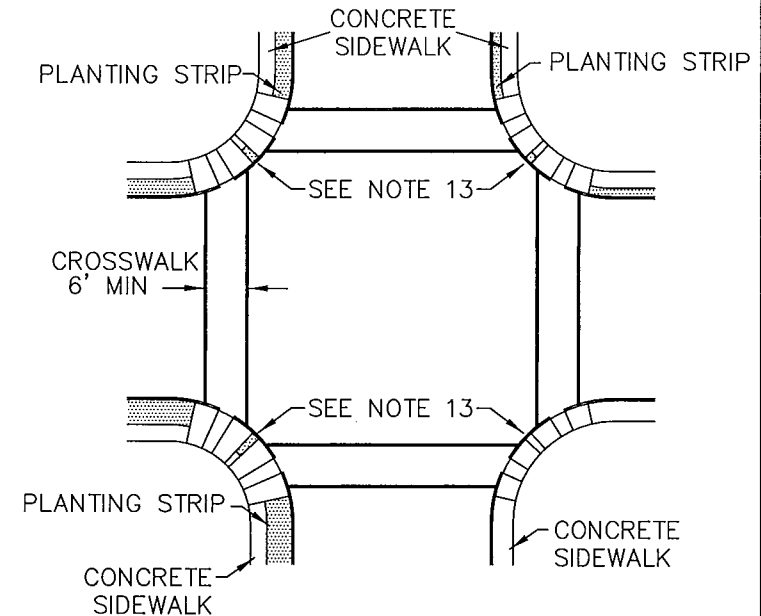
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DETAIL:

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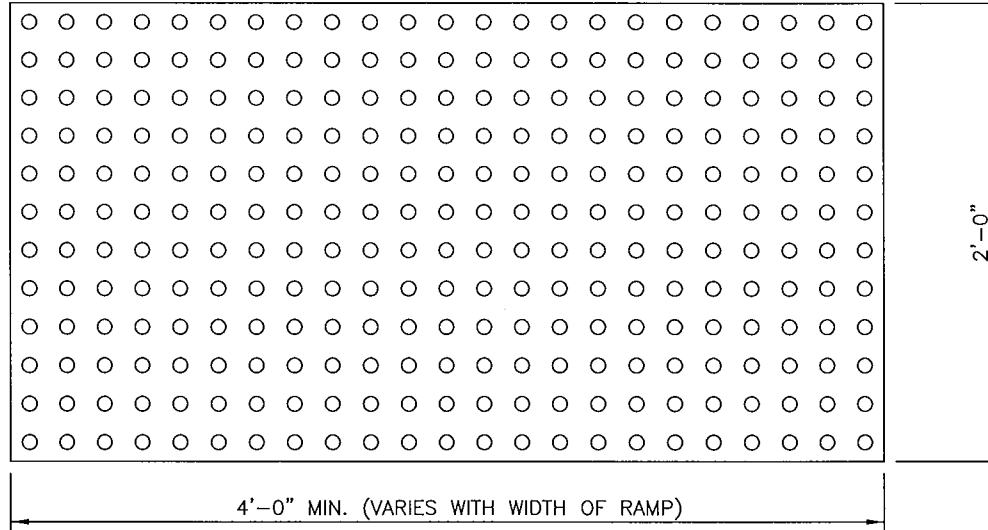
NOTE

1. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION INSPECTION BUREAU AT LEAST 24 HOURS PRIOR TO PLACING CONCRETE. THE CITY WILL INSPECT SUBGRADE, FORMS, GRADE AND ALIGNMENT.
2. CONCRETE SHALL BE 4" THICK AND SHALL BE SCDOT CLASS 3000 IN CONFORMANCE WITH THE APPLICABLE REQUIREMENTS OF SECTION 701 OF THE SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION. CONCRETE SHALL BE "READY MIX" HAVING A 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI AND BE AIR ENTRAINED.
3. THE SUBGRADE SHALL BE THOROUGHLY COMPACTED TO 95 PERCENT OF THE STANDARD PROCTOR DENSITY, FINISHED TO A SMOOTH, FIRM SURFACE, AND SHALL BE MOIST AT THE TIME THE CONCRETE IS PLACED. IF NECESSARY, THE CONTRACTOR SHALL UNDERCUT AND REPLACE UNSUITABLE SOIL WITH COMPACTED AGGREGATE BASE COURSE MEETING SCDOT STANDARD SPECIFICATION 305.
4. RAMP SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF SECTION 720.4 OF THE SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION.
5. RAMP SURFACE SHALL RECEIVE A MEDIUM BROOM FINISH.
6. DETECTABLE WARNING SURFACE SHALL BE INSTALLED TO COMPLY WITH CITY OF GREENVILLE DETAIL.
7. RAMP TO HAVE SCORING LINES (CONTRACTION JOINTS) AND $\frac{1}{2}$ " EXPANSION JOINTS WHERE SHOWN.
8. EXPANSION JOINTS AND SCORING LINES SHALL CONFORM TO CITY OF GREENVILLE DETAIL.
9. SIDEWALK AND CURB REPLACEMENT PER CITY OF GREENVILLE DETAILS.
10. GUTTER LINE TYPICALLY INSTALLED WITH SMOOTH TRANSITION. INSTALLATION OF A NUISANCE TROUGH, PER STANDARD DETAIL, MAY BE REQUIRED AT THE DIRECTION OF THE CITY ENGINEER.
11. THE RAMP OPENING (AT THE FULLY DEPRESSED CURB) SHALL BE LOCATED WITHIN THE PARALLEL BOUNDARIES OF THE CROSSWALK MARKINGS.
12. DRAINAGE STRUCTURES, MAST ARMS, LIGHT POLES AND OTHER OBSTRUCTIONS SHALL NOT BE PLACED IN LINE WITH RAMPS. LOCATION OF THE RAMP SHALL TAKE PRECEDENCE OVER LOCATION OF OBSTRUCTIONS EXCEPT WHERE EXISTING OBSTRUCTIONS ARE BEING UTILIZED IN THE NEW CONSTRUCTION.
13. AT ALL LOCATIONS, NOT LESS THAN 3 FEET OF FULL HEIGHT CURB SHALL BE PLACED BETWEEN THE RAMPS.
14. LOCATION AND TYPE OF RAMP SHALL CLEARLY BE DENOTED ON THE PLANS.
15. CROSSWALKS SHALL BE DESIGNATED WHERE DIRECTED BY CITY ENGINEER.

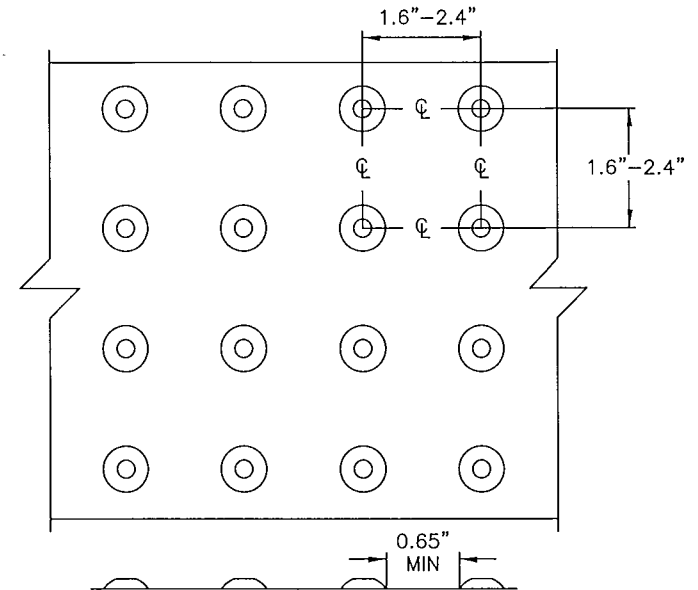


TYPICAL LOCATION OF ACCESSIBLE RAMPS
AND PEDESTRIAN CROSSWALKS

DIRECTION OF
PEDESTRIAN TRAVEL



TRUNCATED DOME PLAN VIEW

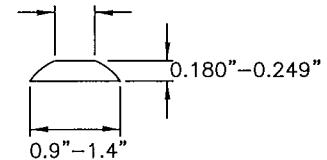


TRUNCATED DOME SPACING

NOTE

- DETECTABLE WARNING SURFACES SHALL BE PROVIDED AT THE FOLLOWING LOCATIONS:
 - WHERE A SIDEWALK CROSSES A VEHICULAR WAY, EXCLUDING UN-SIGNALIZED DRIVEWAY CROSSINGS.
 - WHERE A RAIL SYSTEM CROSSES A PEDESTRIAN FACILITY THAT IS NOT SHARED WITH VEHICLES.
 - AT ISLANDS AND MEDIANS THAT ARE CUT THROUGH LEVEL WITH THE ROADWAY.
- AT CURB RAMPS AND BLENDED TRANSITIONS, DETECTABLE WARNING SURFACES SHALL BE LOCATED SO THE EDGE NEAREST THE GUTTER LINE IS 6" MINIMUM AND 8" MAXIMUM DISTANCE FROM THE GUTTER LINE. THE SURFACE SHALL EXTEND A MINIMUM OF 24" ONTO THE RAMP IN THE DIRECTION OF TRAVEL FOR THE FULL WIDTH OF THE CURB RAMP (MINIMUM 4 FEET).
- AT RAIL CROSSINGS, THE DETECTABLE WARNING SURFACE SHALL BE 24" DEEP AND FULL WIDTH OF THE SIDEWALK (MINIMUM 4 FEET). THE EDGE OF THE SURFACE NEAREST THE RAIL CROSSING IS 6" MINIMUM AND 8" MAXIMUM DISTANCE FROM THE VEHICLE DYNAMIC ENVELOPE (6' FROM THE NEAREST RAIL) UNLESS OTHERWISE NOTED BY THE RAILROAD.
- ALL DETECTABLE WARNING DEVICES USED IN NEW CONSTRUCTION SHALL BE OF A RIDGID PRECAST OR EMBEDDED PRODUCT APPROVED BY THE CITY ENGINEER. RETRO FIT MATS WILL ONLY BE ALLOWED ON EXISTING RAMPS WITH PRIOR APPROVAL BY THE CITY ENGINEER FOR MATERIAL TYPE AND INSTALLATION (I.E. RESURFACING PROJECTS).
- DETECTABLE WARNING SURFACES SHALL CONSIST OF AN AREA OF TRUNCATED DOMES ALIGNED IN A SQUARE GRID PATTERN. THE BASE OF THESE DOMES SHALL BE 0.90"-1.40". THE TOP DIAMETER OF THE DOMES SHALL BE 50%-65% OF THE ACTUAL BASE DIAMETER, WITH A MINIMUM INDIVIDUAL HEIGHT OF 0.180" AND A MAXIMUM HEIGHT OF 0.249". THE AVERAGE OF TEN (10) INDIVIDUAL NODES PICKED AT RANDOM IN ANY SQUARE FOOT AREA SHALL MEASURE 0.180"-0.249" IN HEIGHT. THE DETECTABLE WARNING DOMES SHALL HAVE A CENTER-TO-CENTER SPACING OF 1.6-2.4".
- DETECTABLE WARNING DOMES SHALL BE ALIGNED ON A SQUARE GRID IN THE PREDOMINANT DIRECTION OF TRAVEL TO PERMIT WHEELS TO ROLL BETWEEN DOMES.
- IF PAVERS ARE TO BE USED, PAVERS SHALL BE 6" THICK AND CAST FROM 5000 PSI CONCRETE.
- IF PANELS ARE TO BE USED, PANELS SHALL BE RIGID WITH TURN DOWN EDGES EMBEDDED IN CONCRETE TO REDUCE TRIP HAZARD.

50-65% OF ACTUAL
BASE DIAMETER



TRUNCATED DOME SECTION

*ADAPTED FROM SCDOT STANDARD DRAWING 720-905-02

10. FOR ALL DETECTABLE WARNING SURFACES, THE CITY OF GREENVILLE'S DEFAULT COLOR IS BRICK RED UNLESS A SPECIFIC PROJECT REQUIRES ANOTHER COLOR. WHEN A COLOR OTHER THAN BRICK RED IS SELECTED FOR A PROJECT, IT MUST MEET THE APPROVAL OF ALL APPLICABLE DEPARTMENTS. THE COLOR SELECTED SHALL CONTRAST EITHER LIGHT-ON-DARK OR DARK-ON LIGHT. THE MANUFACTURER MUST CERTIFY TO THE CITY ENGINEER THAT THE COLOR SELECTED MEETS THE 70% CONTRAST SPECIFICATIONS OF THE ADAAG.

 **city of
greenville**
ENGINEERING DIVISION

DETECTABLE WARNING SURFACE

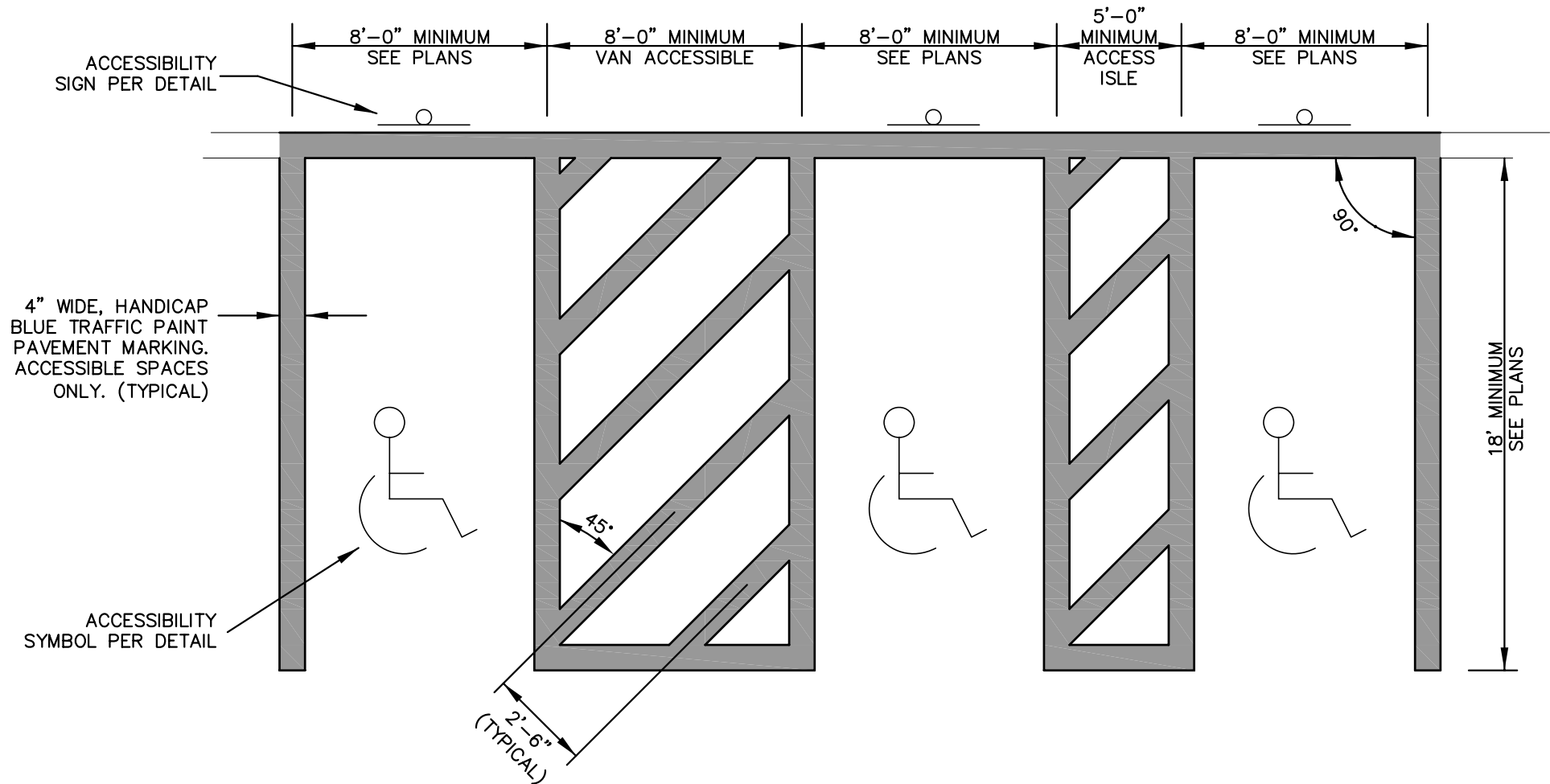
DATE
APPROVED: AUG. 2008

OFFICE OF THE
CITY ENGINEER: *Philip B. Lindsey*

SCALE:
NO SCALE

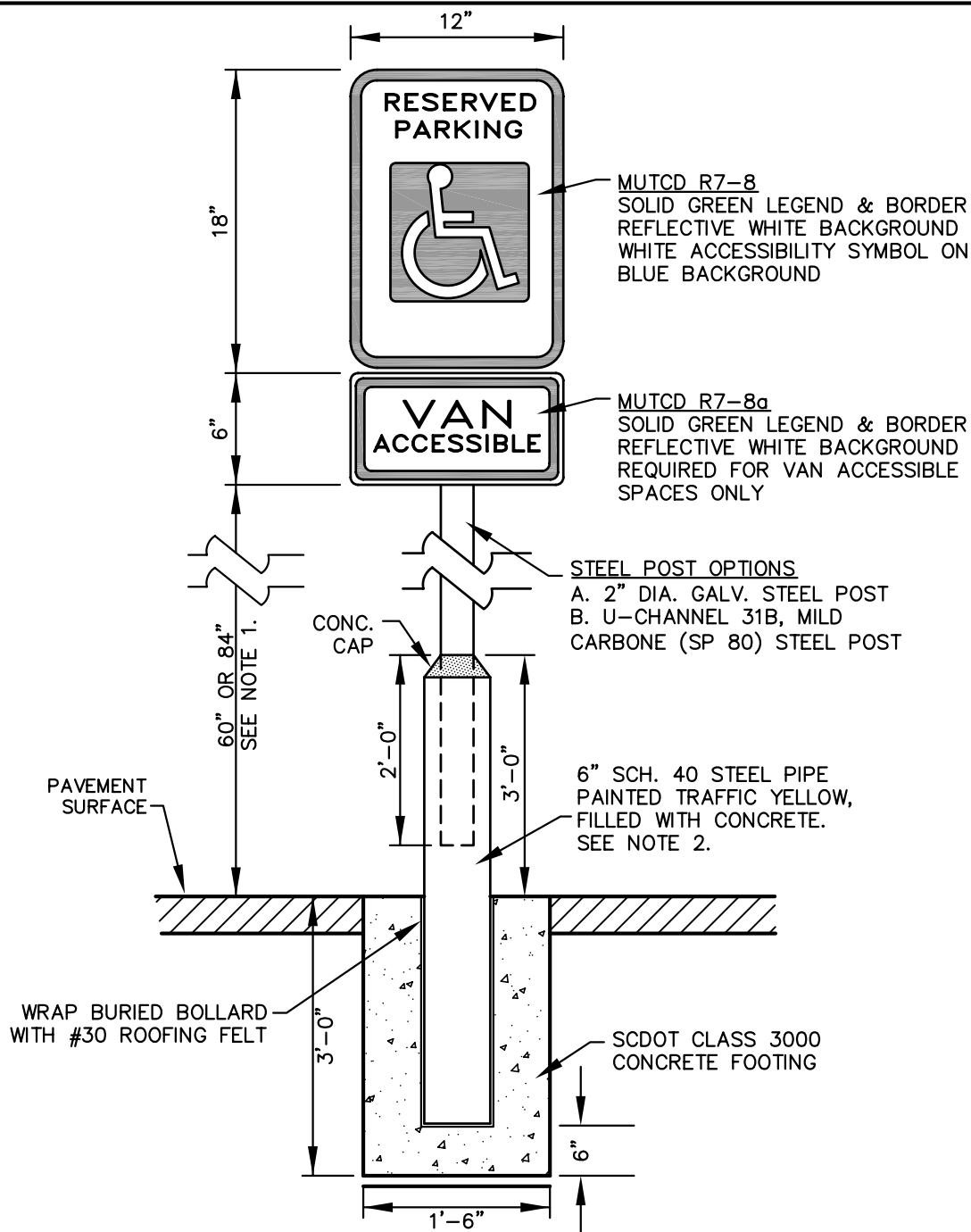
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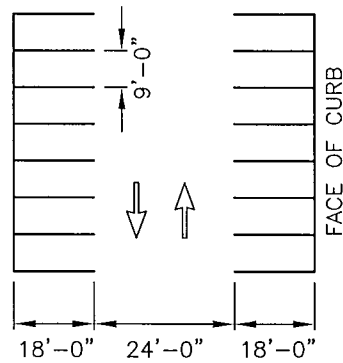
NOTE

1. FINISH GRADE ACROSS HANDICAP ACCESSIBLE SPACES AND AISLES SHALL NOT EXCEED 2% (50:1) IN ANY DIRECTION.
2. 90° PARKING LAYOUT SHOWN. STRIPING ORIENTATION AND DIMENSIONS SIMILARLY SHALL APPLY TO ANGLED PARKING ALIGNMENT.

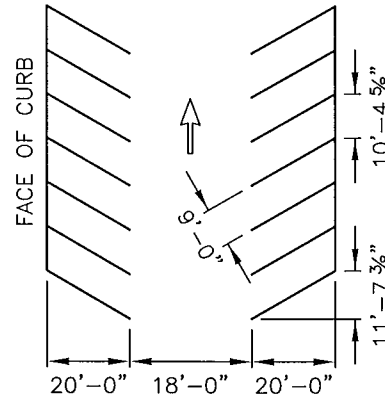


NOTE

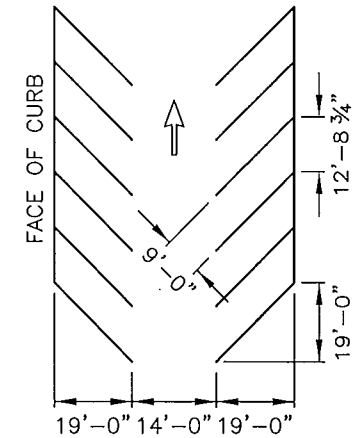
1. 12"x18" ACCESSIBILITY SIGN (R7-8) SHALL BE MOUNTED 7' FROM FINISH GRADE TO BOTTOM EDGE OF SIGN FACE. MOUNTING HEIGHT MAY BE REDUCED TO 5' IF PLACED IN A LANDSCAPE AREA IN WHICH PEDESTRIANS ARE NOT EXPECTED TO USE.
2. BOLLARD MAY BE OMITTED IF INSTALLED IN LANDSCAPE AREAS. WHEN INSTALLED IN LANDSCAPE AREAS, MOUNTING POST SHALL BE DRIVEN A MINIMUM OF 3' BELOW FINISH GRADE. ALTERNATE MOUNTING POSTS MUST BE APPROVED BY THE CITY ENGINEER PRIOR TO CONSTRUCTION.
3. SIGNAGE SHALL BE INSTALLED IN FRONT OF EACH ACCESSIBLE SPACE, CENTERED ON THE WIDTH OF THE SPACE.
4. REFER TO AMERICANS WITH DISABILITIES ACT AND ARCHITECTURAL BARRIERS ACT ACCESSIBILITY GUIDELINES (ADAAG), LATEST EDITION, FOR REQUIRED NUMBER OF ACCESSIBLE SPACES. PER ADAAG, ONE VAN ACCESSIBLE SPACE SHALL BE PROVIDED, MINIMUM, WITH ADDITIONAL VAN ACCESSIBLE SPACES PER ADAAG REQUIREMENTS.
5. ALL SIGNAGE SHALL BE ENGINEER GRADE .080 ALUMINUM REFLECTIVE SIGN MEETING THE REQUIREMENTS OF THE MUTCD AND ADAAG.



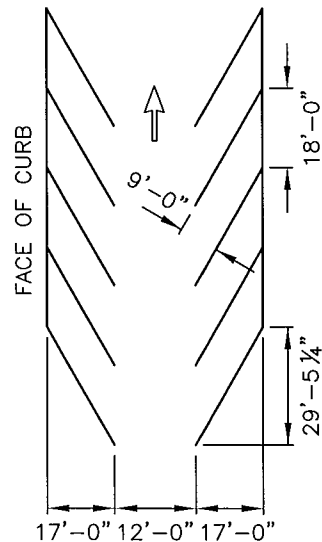
PARKING ANGLE 90°



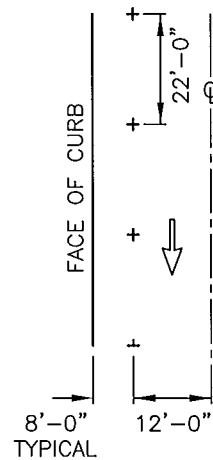
PARKING ANGLE 60°



PARKING ANGLE 45°



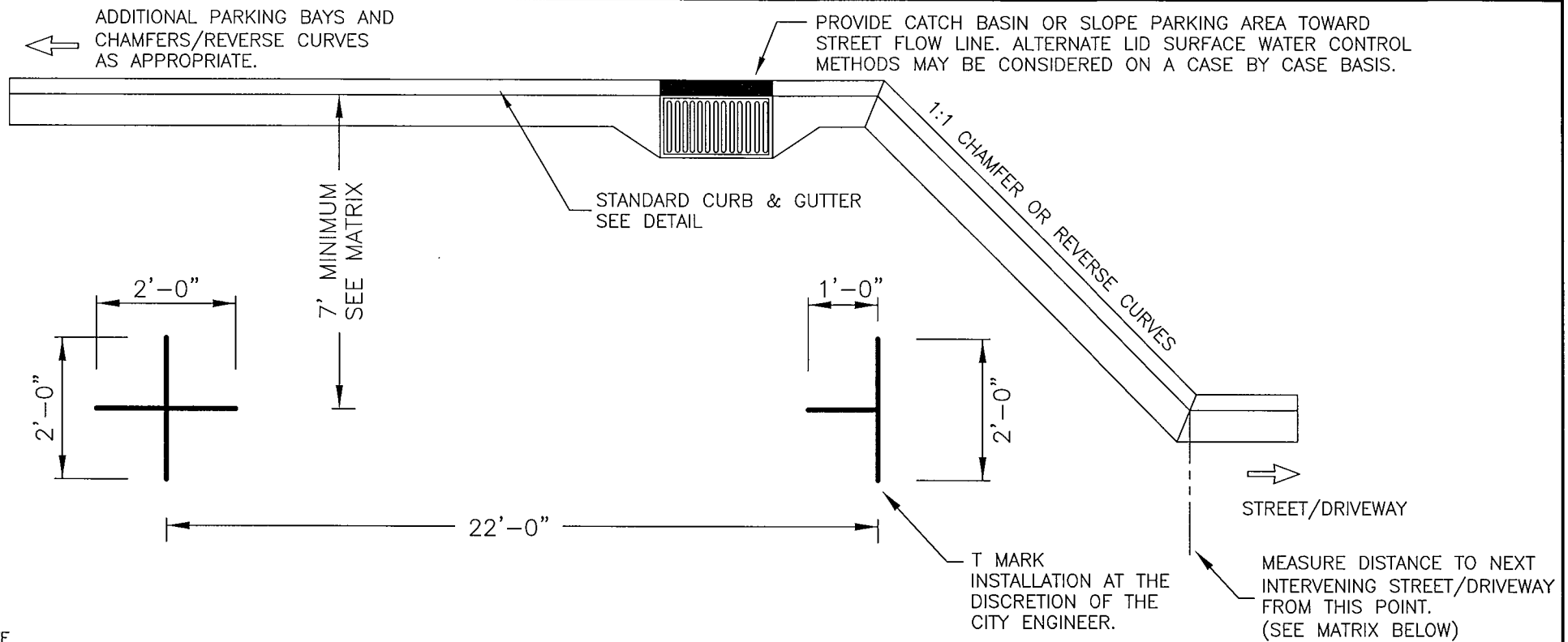
PARKING ANGLE 30°



PARALLEL PARKING

NOTE

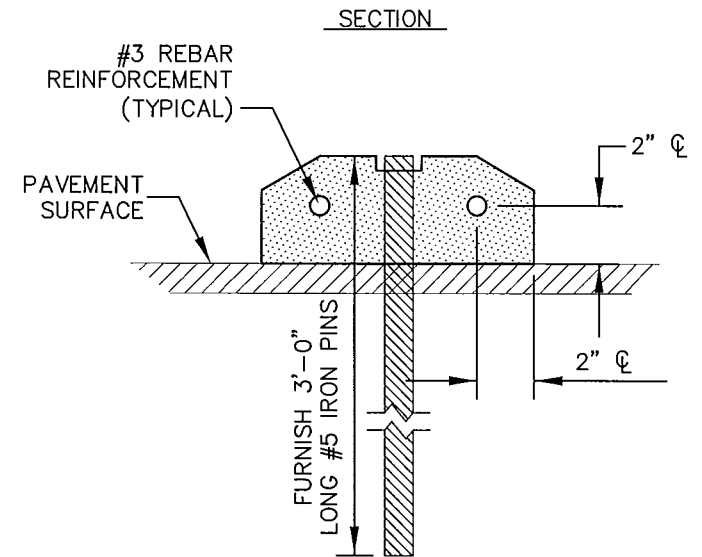
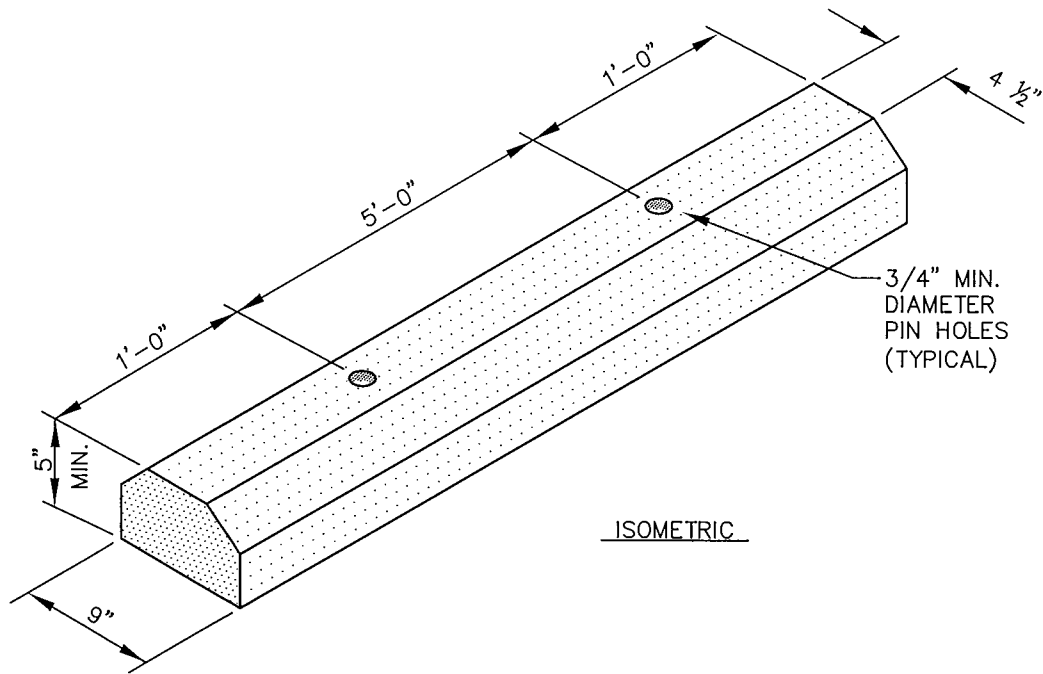
1. FOR ACCESSIBLE PARKING STANDARDS, SEE CITY OF GREENVILLE DETAILS.
2. PAVEMENT MARKINGS SHALL BE 4" WHITE PAINT UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER PRIOR TO CONSTRUCTION.
3. ALTERNATIVE PARKING ANGLES, AISLE WIDTHS, AND OPERATION (TWO-WAY ANGLED PARKING OR REVERSE-ANGLE PARKING) MUST BE SUBMITTED TO THE CITY ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION.
4. PARALLEL PARKING STALLS SHOULD BE MARKED WITH 2' X 2' CROSS MARKS BETWEEN SPACES AND 1' X 2' T MARKS AT ENDS OF ROWS.



NOTE

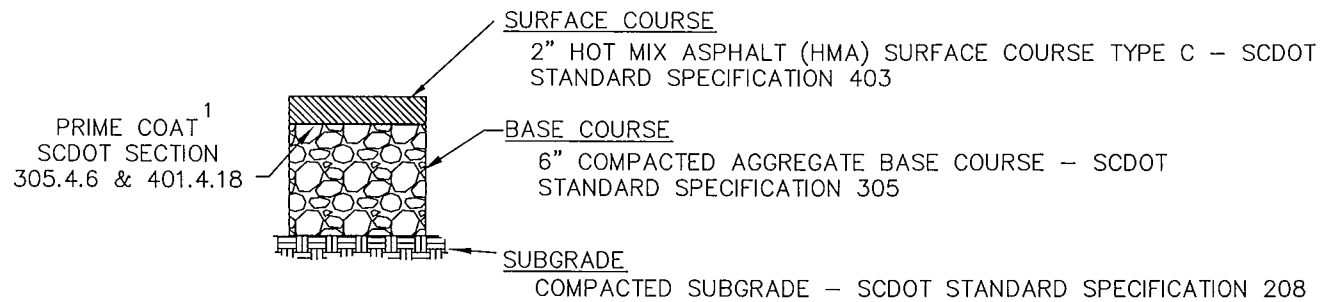
1. ALL PARKING STRIPING SHALL BE 4" WIDE WHITE THERMOPLASTIC.
2. USE 2' X 2' CROSS MARKS BETWEEN SPACES. USE 1' X 2' T MARKS AT ENDS OF ROWS, WHERE DETERMINED APPLICABLE BY THE CITY ENGINEER.
3. PARALLEL ACCESSIBLE SPACES AND LOADING ZONES TO BE REVIEWED BY THE CITY ENGINEER ON A CASE-BY-CASE BASIS. ALL ACCESSIBLE SPACES SHALL MEET ADA REQUIREMENTS.
4. GREATER SEPARATION FROM INTERVENING STREETS THAN THE DISTANCES PROVIDED IN THE MATRIX MAY BE REQUIRED AT THE CITY ENGINEER'S DISCRETION.
5. THE DESIGN ENGINEER SHALL CONFER WITH THE CITY ENGINEER REGARDING STALL DEPTH.
6. POSITIVE DRAINAGE SHALL BE PROVIDED EITHER BY INSTALLING APPROPRIATE DRAINAGE STRUCTURES OR SLOPING PARKING AREA TO STREET FLOW LINE.

PARALLEL PARKING BAY LOCATED ON	MINIMUM DISTANCE TO NEXT INTERVENING STREET			TYPICAL STALL DEPTH
	DRIVEWAY	LOCAL RESIDENTIAL	COLLECTOR	
LOCAL RESIDENTIAL	10'	30'	30'	7'
COLLECTOR	25'	30'	35'	8'-6"



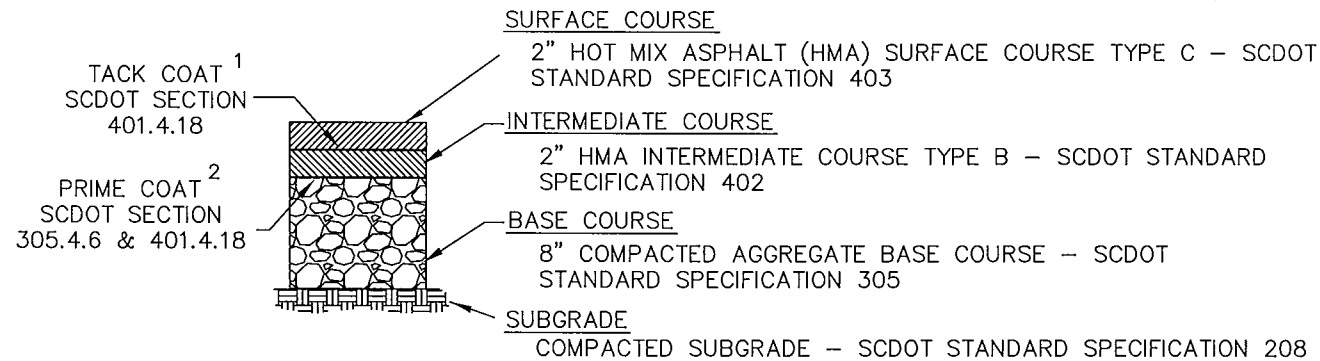
NOTE

1. WHEEL STOPS SHALL BE STEEL REINFORCED PRECAST UNITS CONSISTING OF SCDOT CLASS 3000 CONCRETE, MINIMUM. ALTERNATE MATERIAL COMPOSITION MUST BE APPROVED BY THE CITY ENGINEER PRIOR TO INSTALLATION.
2. WHEEL STOPS SHALL BE INSTALLED PERPENDICULAR TO PARKING STALL AND SHALL BE PLACED A MINIMUM OF 24" FROM END OF PARKING STALL OR OBSTRUCTION.
3. ANCHORING PINS SHALL BE DRIVEN FLUSH TO THE TOP OF THE WHEEL STOP AND PIN HOLES SHALL BE GROUTED UPON INSTALLATION.



STANDARD DUTY PAVEMENT SECTION

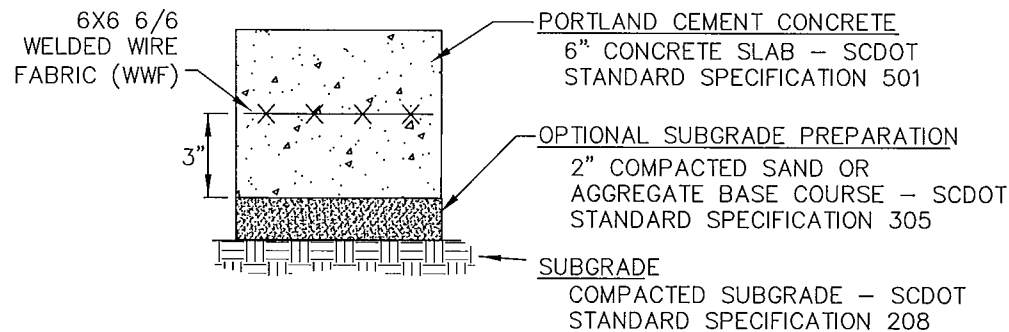
1. APPLICATION RATE FOR MACADAM AND RECYCLED PORTLAND CEMENT BASE COURSE SHALL BE 0.25 – 0.30 GAL PER SQUARE YARD



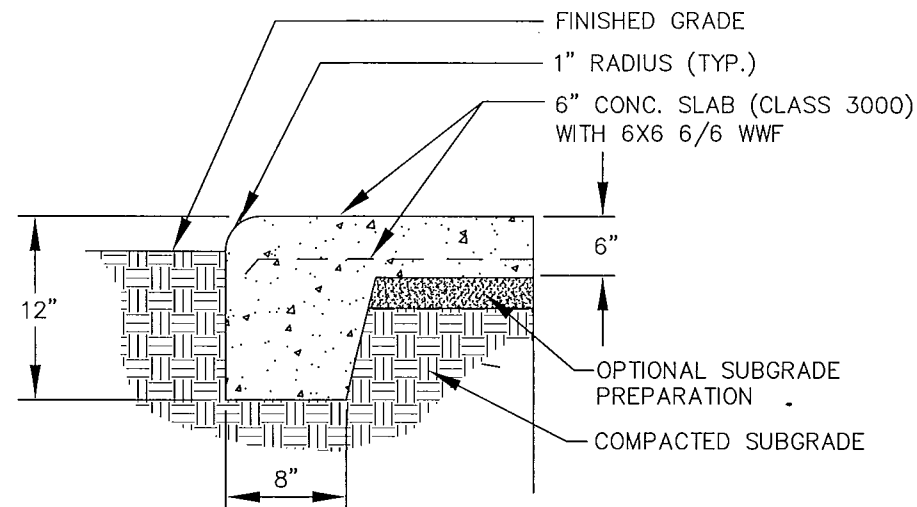
HEAVY DUTY PAVEMENT SECTION

1. APPLICATION RATE FOR LAYING ANY HMA ON EXISTING PAVEMENTS SHALL BE 0.05 – 0.15 GAL PER SQUARE YARD

2. APPLICATION RATE FOR MACADAM AND RECYCLED PORTLAND CEMENT BASE COURSE SHALL BE 0.25 – 0.30 GAL PER SQUARE YARD



STANDARD DUTY PAVEMENT SECTION



EDGE TREATMENT

NOTE

1. CONCRETE SHALL BE SCDOT CLASS 3000 IN CONFORMANCE WITH THE APPLICABLE REQUIREMENTS OF SECTION 701 OF THE SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION. CONCRETE SHALL BE "READY MIX" HAVING A 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI AND BE AIR ENTRAINED.
2. PAVEMENT TO HAVE LONGITUDINAL, EXPANSION, AND TRANSVERSE CONTRACTION JOINTS AS SHOWN ON THE PLANS OR SPECIFIED IN THE SPECIAL PROVISIONS. CONSTRUCT JOINTS IN ACCORDANCE WITH SCDOT STANDARD SPECIFICATION 501.4.13.
3. PAVEMENT SHALL BE CONSTRUCTED IN CONFORMANCE WITH THE APPLICABLE REQUIREMENTS OF SECTION 501 OF THE SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION. SURFACE SHALL TYPICALLY RECEIVE A MEDIUM BROOM FINISH UNLESS OTHERWISE DIRECTED ON THE PLANS OR IN THE SPECIAL PROVISIONS.
4. THE SUBGRADE SHALL BE THOROUGHLY COMPACTED TO 95 PERCENT OF THE STANDARD PROCTOR DENSITY AND FINISHED TO A SMOOTH, FIRM SURFACE AND SHALL BE MOIST AT THE TIME THE CONCRETE IS PLACED.
5. EDGES OF SLAB SHALL BE THICKENED AS SHOWN IN THE DETAIL.

NOTE

1. FINAL DIMENSIONS OF EACH LAYER OF THE PERVIOUS CONCRETE PAVING SECTION MUST BE DETERMINED BY THE DESIGN ENGINEER AND SHOWN HEREIN.

2. PERVIOUS CONCRETE LAYER – THE POROUS CONCRETE LAYER CONSISTS OF AN OPEN-GRADED CONCRETE MIXTURE USUALLY RANGING FROM A MINIMUM DEPTH OF 4 INCHES TO 6 INCHES OR GREATER DEPENDING ON REQUIRED BEARING STRENGTH AND PAVEMENT DESIGN REQUIREMENTS. POROUS CONCRETE SHOULD CONTAIN APPROXIMATELY 18 PERCENT VOIDS (POROSITY = 0.18). MIX DESIGN SHOULD OMIT FINE AGGREGATE AND USE A 3/8 INCH MAXIMUM SIZE COARSE AGGREGATE. PLACEMENT SHALL FOLLOW PUBLISHED GUIDELINES.

3. OPTIONAL TOP FILTER LAYER – CONSISTS OF A 0.5 INCH DIAMETER CRUSHED STONE TO A DEPTH OF 1 TO 2 INCHES FOR STABILIZATION OF THE PERVIOUS PAVEMENT LAYER.

4. RESERVOIR LAYER – THE RESERVOIR GRAVEL BASE COURSE CONSISTS OF WASHED, BANK-RUN GRAVEL, 1.5 TO 2.5 INCHES IN DIAMETER WITH APPROXIMATELY 40% VOID SPACE. THE DEPTH OF THIS LAYER IS TYPICALLY 2 TO 4 FEET DEPENDING ON THE DESIRED STORAGE VOLUME, WHICH IS A FUNCTION OF THE SOIL INFILTRATION RATE AND VOID SPACES. THE LAYER MUST HAVE A MINIMUM DEPTH OF 6 INCHES. THE LAYER SHOULD DRAIN COMPLETELY IN 48 TO 72 HOURS. AGGREGATE CONTAMINATED WITH SOIL SHALL NOT BE USED.

5. BOTTOM FILTER LAYER – THE SURFACE OF THE SUBGRADE SHOULD BE A 6 INCH LAYER OF SAND (ASTM C-33 CONCRETE SAND) OR A 2 INCH THICK LAYER OF 0.5 INCH CRUSHED STONE, AND BE COMPLETELY FLAT TO PROMOTE INFILTRATION ACROSS THE ENTIRE SURFACE. THIS LAYER SERVES TO STABILIZE THE RESERVOIR LAYER, TO PROTECT THE UNDERLYING SOIL FROM COMPACTION, AND ACT AS THE INTERFACE BETWEEN THE RESERVOIR LAYER AND THE FILTER FABRIC COVERING THE UNDERLYING SOIL.

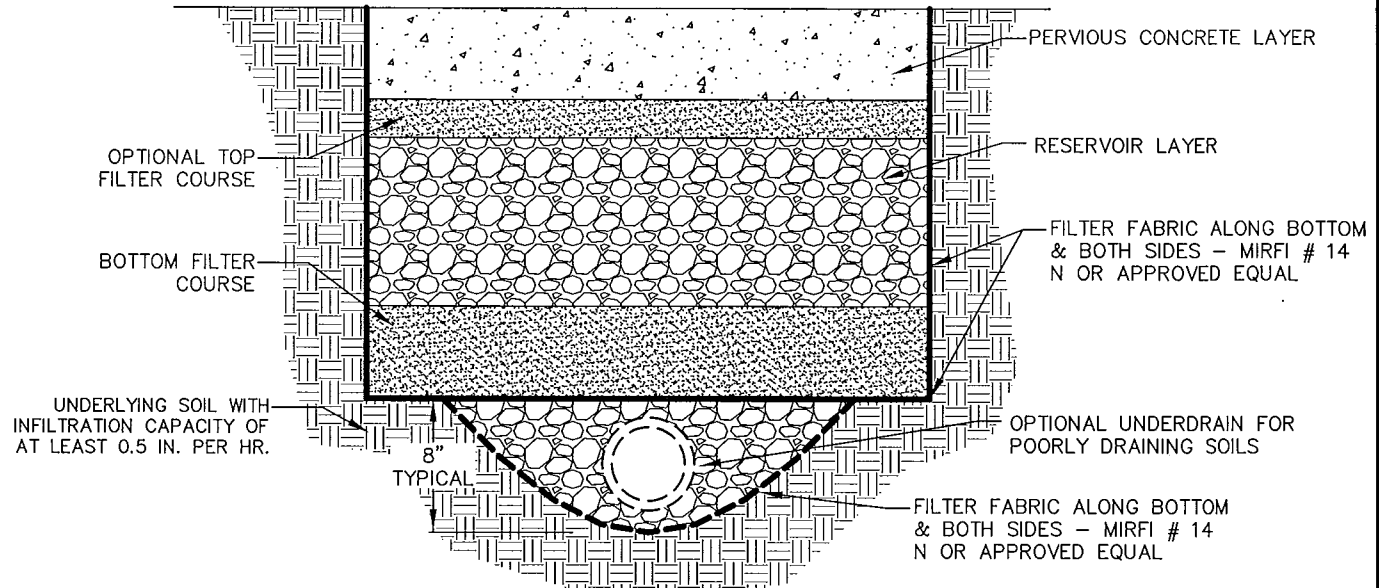
6. FILTER FABRIC – THE ENTIRE TRENCH AREA, INCLUDING THE SIDES, SHALL BE LINED WITH FILTER FABRIC (MIRFI # 14 N OR APPROVED EQUIVALENT) PRIOR TO PLACEMENT OF THE AGGREGATE.

7. UNDERLYING SOIL – THE UNDERLYING SOIL SHOULD HAVE AN INFILTRATION CAPACITY OF AT LEAST 0.5 IN/HR (MEASURED AT SUBGRADE ELEVATION) AS CONFIRMED BY FIELD GEOTECHNICAL TESTS. MINIMUM GEOTECHNICAL TESTING IS ONE TEST HOLE PER 5000 SQUARE FEET, WITH A MINIMUM OF TWO BORINGS TAKEN WITHIN THE PROPOSED LIMITS OF THE FACILITY. POORLY DRAINING SOILS WILL REQUIRE THE INSTALLATION OF AN UNDERDRAIN SYSTEM.

8. PIT EXCAVATION SHOULD BE LIMITED TO THE WIDTH AND DEPTH SPECIFIED IN THE DESIGN. EXCAVATED MATERIAL SHOULD BE PLACED AWAY FROM THE OPEN TRENCH AS NOT TO JEOPARDIZE THE STABILITY OF THE TRENCH SIDEWALLS. THE BOTTOM OF THE EXCAVATED TRENCH SHOULD NOT BE LOADED SO AS TO CAUSE COMPACTION, AND SHOULD BE SCARIFIED PRIOR TO PLACEMENT OF THE BOTTOM FILTER LAYER. THE SIDES OF THE TRENCH SHALL BE TRIMMED OF ALL LARGE ROOTS. THE SIDEWALLS SHALL BE UNIFORM WITH NO VOIDS AND SCARIFIED PRIOR TO BACKFILLING. ALL INFILTRATION TRENCH FACILITIES SHOULD BE PROTECTED DURING SITE CONSTRUCTION, AND SHOULD BE CONSTRUCTED AFTER UPSTREAM AREAS HAVE BEEN STABILIZED.

9. AN OBSERVATION WELL CONSISTING OF PERFORATED PVC PIPE 4 TO 6 INCHES IN DIAMETER SHOULD BE PLACED AT THE DOWNSTREAM END OF THE FACILITY TO CONFIRM INFILTRATION RATES.

10. A WARNING SIGN SHOULD BE PLACED AT THE FACILITY THAT STATES, "PERVIOUS PAVING USED ON THIS SITE TO REDUCE POLLUTION. DO NOT RESURFACE WITH NON-POROUS MATERIAL. CALL 467-4400 FOR MORE INFORMATION."



 city of
greenville
ENGINEERING DIVISION

PERVIOUS CONCRETE PAVEMENT SECTION

DATE
APPROVED: AUG. 2008

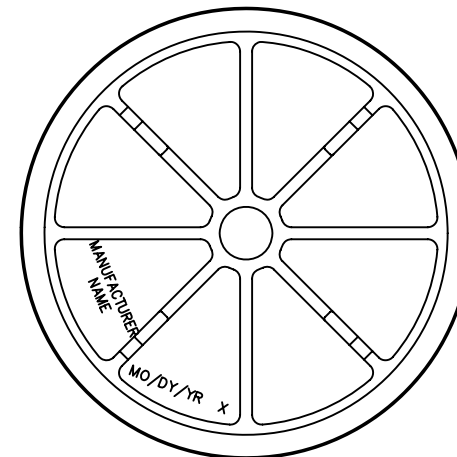
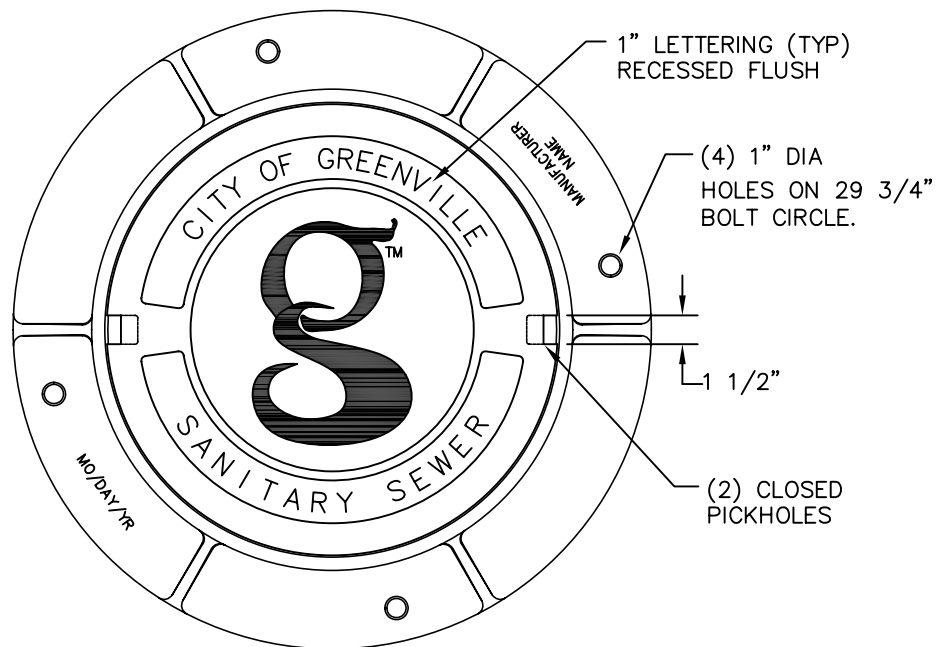
OFFICE OF THE
CITY ENGINEER:

Philip B. Findley

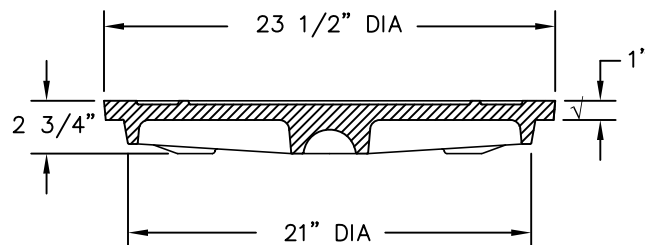
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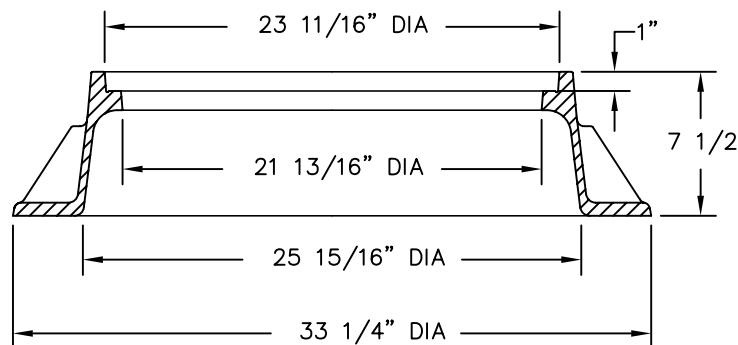
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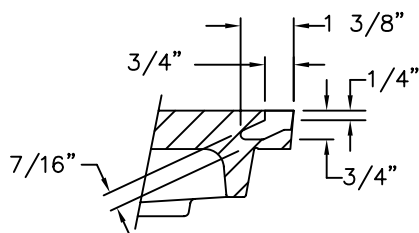
COVER BOTTOM VIEW



COVER SECTION



FRAME SECTION



PICKHOLE DETAIL

NOTE

1. ALL WASTEWATER MANHOLE ASSEMBLIES INSTALLED WITHIN THE CITY SHALL CONFORM TO THIS DETAIL AND CITY OF GREENVILLE SPECIFICATIONS.
2. COVER SHALL BE GRAY IRON CONFORMING TO ASTM A48 CL35B AND SHALL WEIGH APPROXIMATELY 130 POUNDS WITHIN ACCEPTABLE TOLERANCE.
3. FRAME SHALL BE GRAY IRON CONFORMING TO ASTM A48 CL35B AND SHALL WEIGH APPROXIMATELY 160 POUNDS WITHIN ACCEPTABLE TOLERANCE.
4. MANHOLE ASSEMBLY SHALL BE UNDIPPED.
5. "V" DESIGNATES MACHINED SURFACE.
6. LETTERING SHALL BE TRUE TYPE ARIAL FONT HAVING 1/8" RELIEF. LOGO SHALL HAVE 1/2" RELIEF.
7. EJIW PRODUCT NO. 41384169, US FOUNDRY PRODUCT NO. 8015157, OR APPROVED EQUAL.

 city of
greenville
ENGINEERING DIVISION

HEAVY DUTY RING & COVER WASTEWATER UTILITY

DATE
APPROVED: JUNE 2010

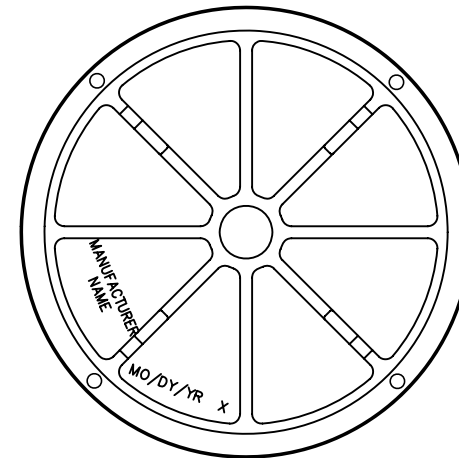
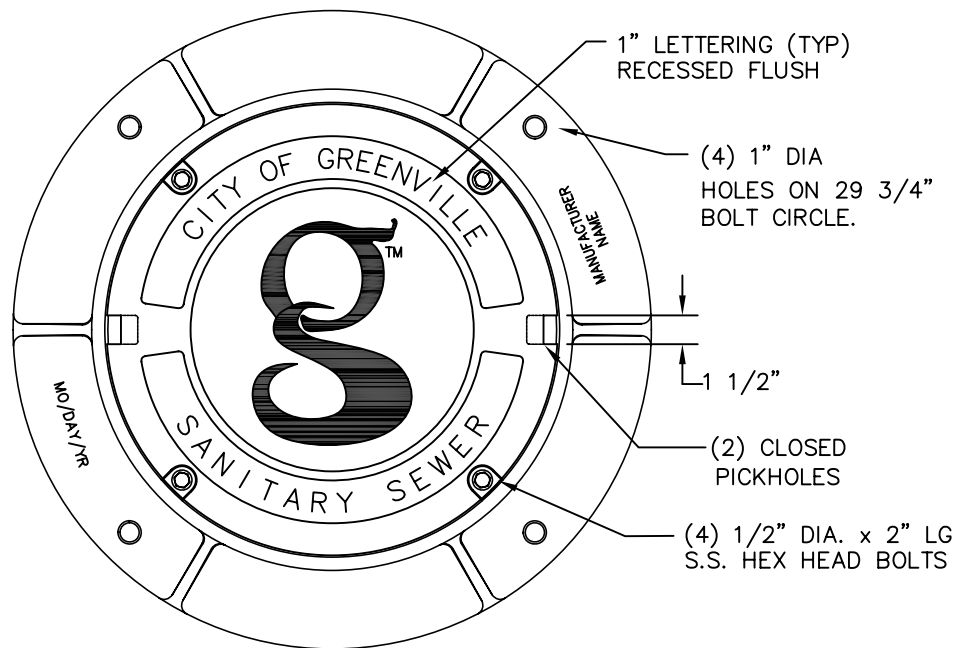
OFFICE OF THE
CITY ENGINEER:

Philip B. Lindsey

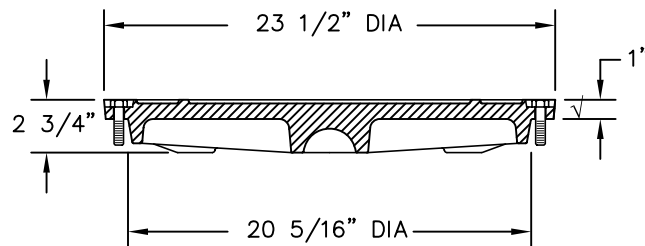
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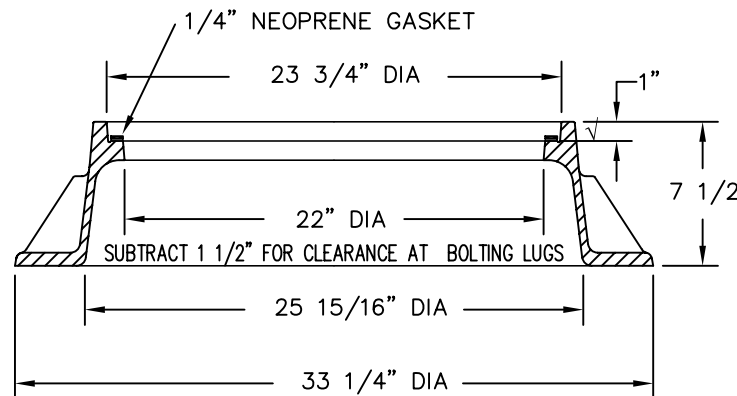
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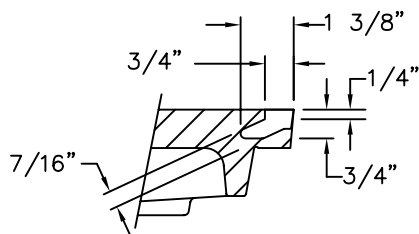
COVER BOTTOM VIEW



COVER SECTION



FRAME SECTION



PICKHOLE DETAIL

NOTE

1. ALL WASTEWATER MANHOLE ASSEMBLIES INSTALLED WITHIN THE CITY SHALL CONFORM TO THIS DETAIL AND CITY OF GREENVILLE SPECIFICATIONS.
2. COVER SHALL BE GRAY IRON CONFORMING TO ASTM A48 CL35B AND SHALL WEIGH APPROXIMATELY 130 POUNDS WITHIN ACCEPTABLE TOLERANCE.
3. FRAME SHALL BE GRAY IRON CONFORMING TO ASTM A48 CL35B AND SHALL WEIGH APPROXIMATELY 160 POUNDS WITHIN ACCEPTABLE TOLERANCE.
4. MANHOLE ASSEMBLY SHALL BE UNDIPPED.
5. "V" DESIGNATES MACHINED SURFACE.
6. LETTERING SHALL BE TRUE TYPE ARIAL FONT HAVING 1/8" RELIEF. LOGO SHALL HAVE 1/2" RELIEF.
7. EJIW PRODUCT NO. V-2384, US FOUNDRY PRODUCT NO. 8015480, OR APPROVED EQUAL.

 city of
greenville
ENGINEERING DIVISION

**WATERTIGHT RING & COVER
WASTEWATER UTILITY**

DATE
APPROVED: JUNE 2010

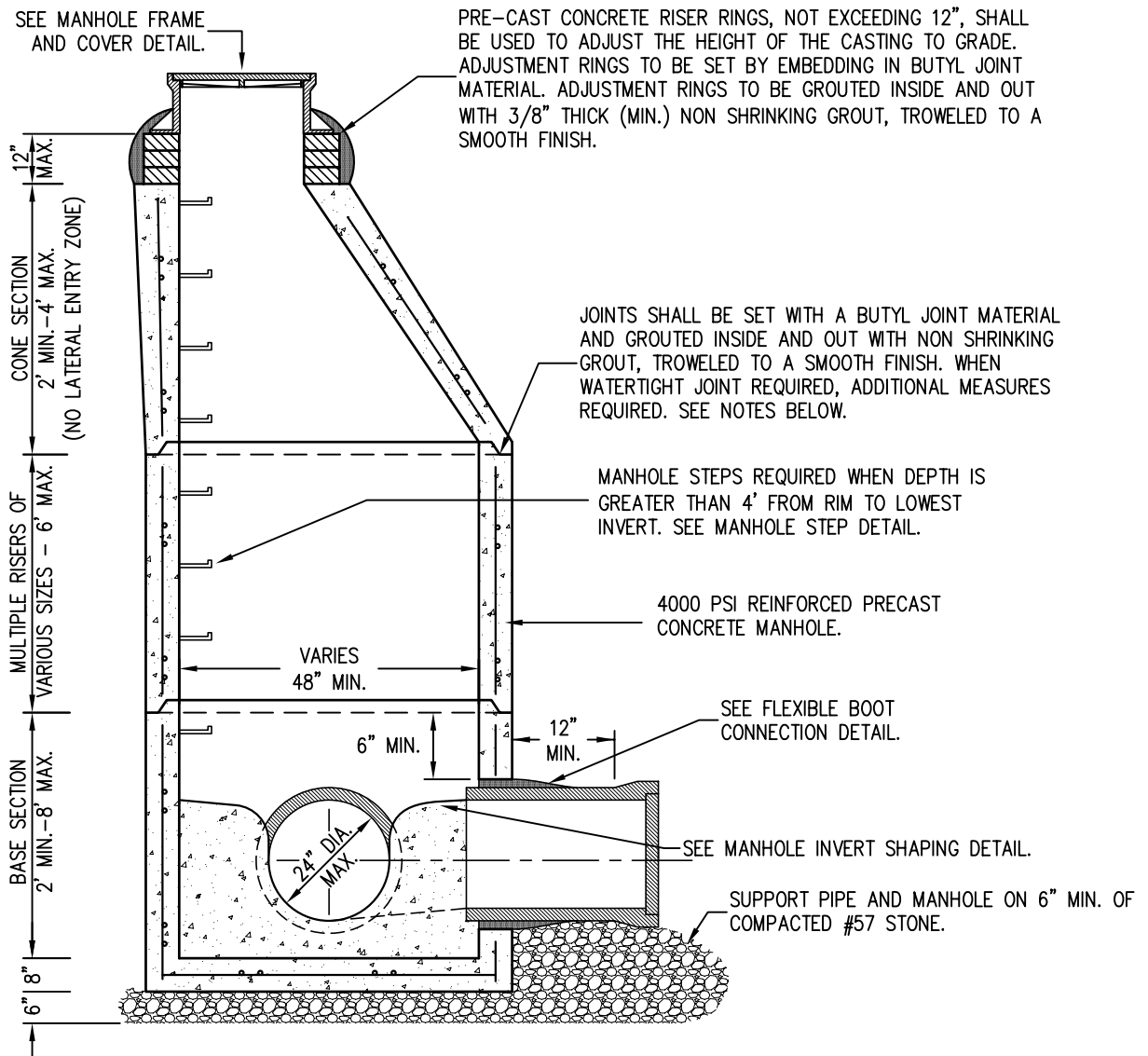
OFFICE OF THE
CITY ENGINEER:

Philip B. Lindsay

SCALE:
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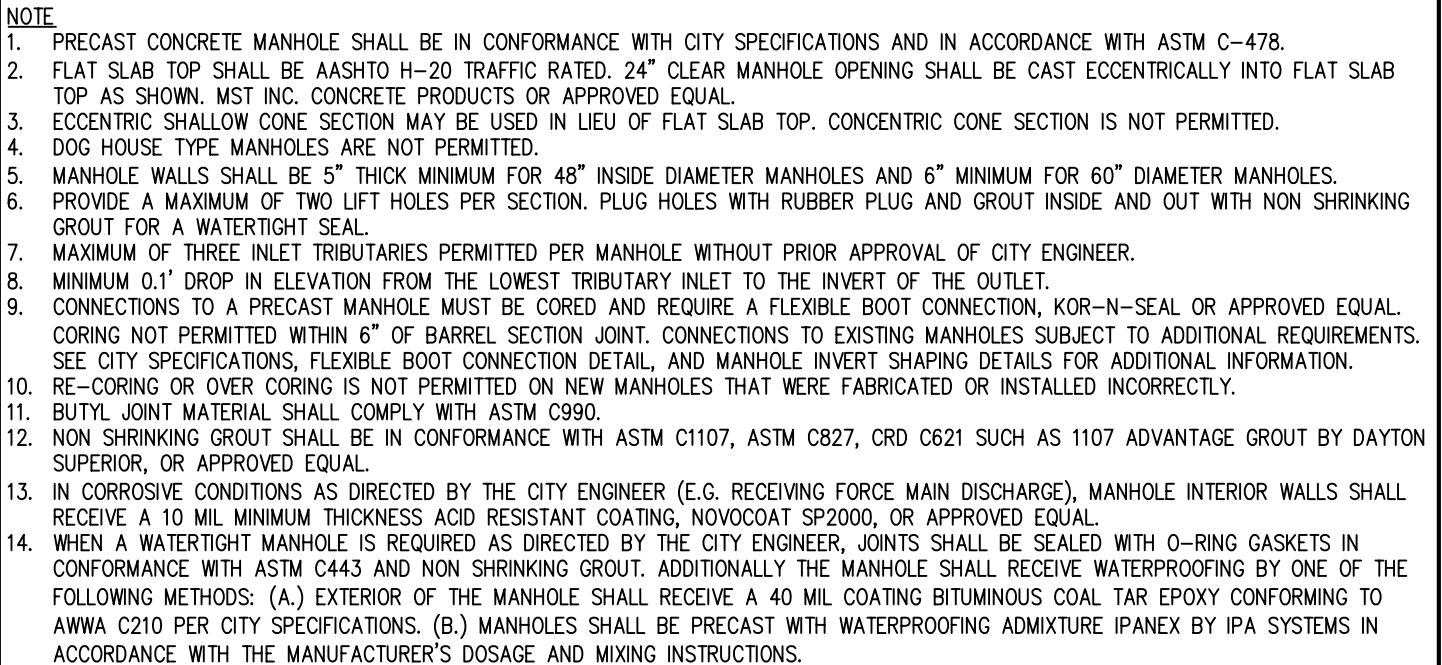
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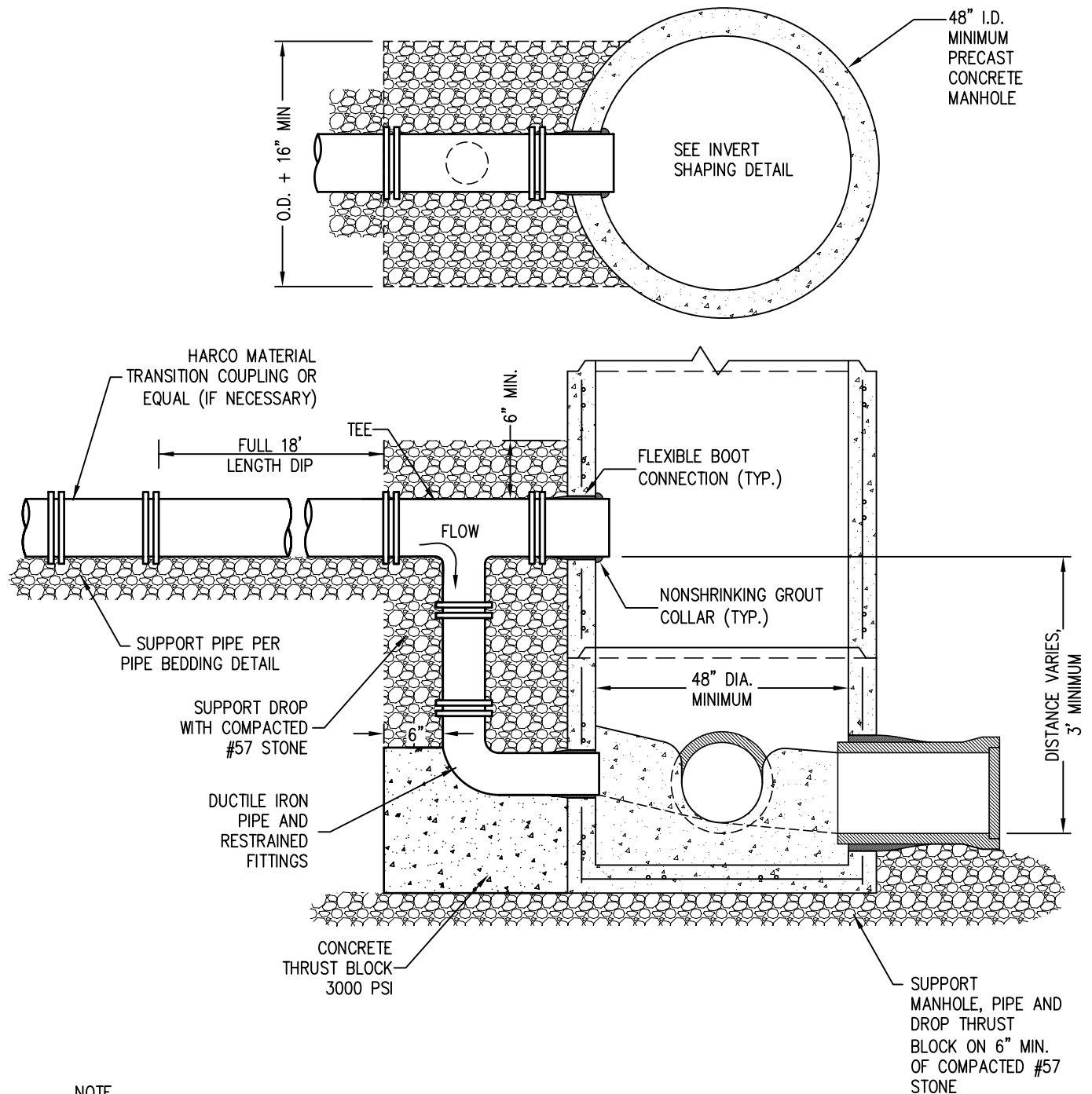
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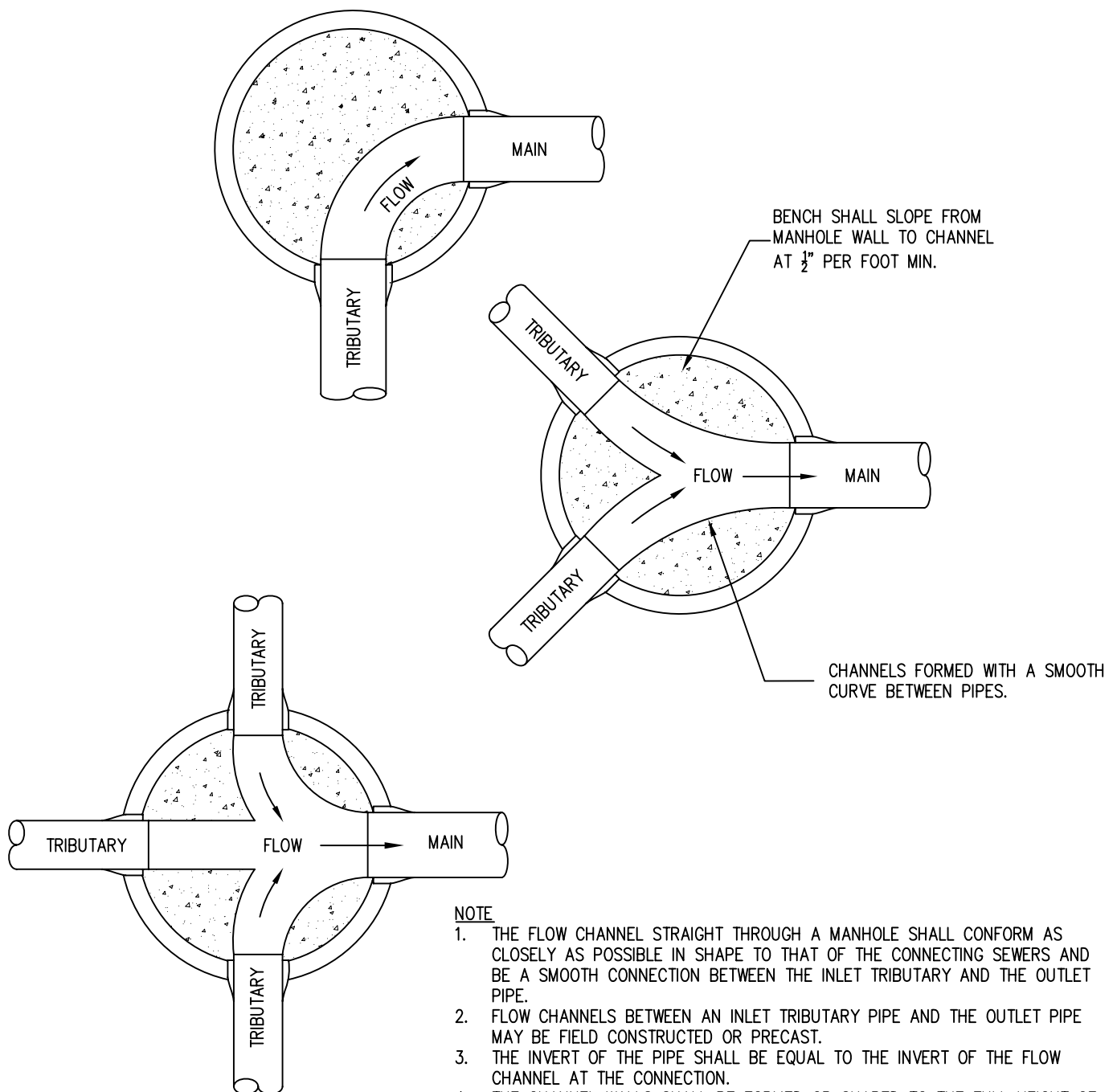
1. PRECAST CONCRETE MANHOLE SHALL BE IN CONFORMANCE WITH CITY SPECIFICATIONS AND IN ACCORDANCE WITH ASTM C-478.
2. ECCENTRIC CONE SECTION SHALL BE USED. CONCENTRIC CONE SECTION IS NOT PERMITTED.
3. DOG HOUSE TYPE MANHOLES ARE NOT PERMITTED.
4. WHEN MANHOLE DEPTH IS GREATER THAN 12' FROM RIM TO LOWEST INVERT, 60" DIA. SHALL BE REQUIRED. FOR MANHOLE DEPTHS GREATER THAN 20', PRIOR APPROVAL FROM THE CITY ENGINEER IS REQUIRED.
5. MANHOLE WALLS SHALL BE 5" THICK MINIMUM FOR 48" INSIDE DIAMETER MANHOLES AND 6" MINIMUM FOR 60" DIAMETER MANHOLES.
6. PROVIDE A MAXIMUM OF TWO LIFT HOLES PER SECTION. PLUG HOLES WITH RUBBER PLUG AND GROUT INSIDE AND OUT WITH NON SHRINKING GROUT FOR A WATERTIGHT SEAL.
7. MAXIMUM OF THREE INLET TRIBUTARIES PERMITTED PER MANHOLE WITHOUT PRIOR APPROVAL OF CITY ENGINEER.
8. MINIMUM 0.1' DROP IN ELEVATION FROM THE LOWEST TRIBUTARY INLET TO THE INVERT OF THE OUTLET.
9. CONNECTIONS TO A PRECAST MANHOLE MUST BE CORED AND REQUIRE A FLEXIBLE BOOT CONNECTION, KOR-N-SEAL OR APPROVED EQUAL. CORING NOT PERMITTED WITHIN 6" OF BARREL SECTION JOINT. CONNECTIONS TO EXISTING MANHOLES SUBJECT TO ADDITIONAL REQUIREMENTS. SEE CITY SPECIFICATIONS, FLEXIBLE BOOT CONNECTION DETAIL, AND MANHOLE INVERT SHAPING DETAILS FOR ADDITIONAL INFORMATION.
10. RE-CORING OR OVER CORING IS NOT PERMITTED ON NEW MANHOLES THAT WERE FABRICATED OR INSTALLED INCORRECTLY.
11. BUTYL JOINT MATERIAL SHALL COMPLY WITH ASTM C990.
12. NON SHRINKING GROUT SHALL BE IN CONFORMANCE WITH ASTM C1107, ASTM C827, CRD C621 SUCH AS 1107 ADVANTAGE GROUT BY DAYTON SUPERIOR, OR APPROVED EQUAL.
13. IN CORROSIVE CONDITIONS AS DIRECTED BY THE CITY ENGINEER (E.G. RECEIVING FORCE MAIN DISCHARGE), MANHOLE INTERIOR WALLS SHALL RECEIVE A 10 MIL MINIMUM THICKNESS ACID RESISTANT COATING, NOVOCOAT SP2000, OR APPROVED EQUAL.
14. WHEN A WATERTIGHT MANHOLE IS REQUIRED AS DIRECTED BY THE CITY ENGINEER, JOINTS SHALL BE SEALED WITH O-RING GASKETS IN CONFORMANCE WITH ASTM C443 AND NON SHRINKING GROUT. ADDITIONALLY THE MANHOLE SHALL RECEIVE WATERPROOFING BY ONE OF THE FOLLOWING METHODS: (A.) EXTERIOR OF THE MANHOLE SHALL RECEIVE A 40 MIL COATING BITUMINOUS COAL TAR EPOXY CONFORMING TO AWWA C210 PER CITY SPECIFICATIONS. (B.) MANHOLES SHALL BE PRECAST WITH WATERPROOFING ADMIXTURE IPANEX BY IPA SYSTEMS IN ACCORDANCE WITH THE MANUFACTURER'S DOSAGE AND MIXING INSTRUCTIONS.





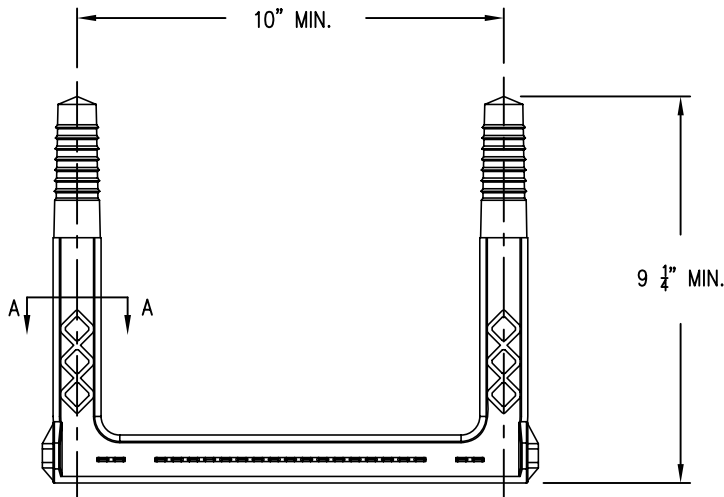
NOTE

1. LOCATION OF STEPS SHALL NOT CONFLICT WITH DROP CONNECTION.
2. PROVIDE CHANNEL WITH CONTINUOUS INVERT FROM DROP CONNECTION TO INVERT OF SEWER MAIN.
3. SEE DETAIL OF STANDARD PRECAST CONCRETE MANHOLE FOR ADDITIONAL DETAILS AND REQUIREMENTS.
4. NO EXTERNAL DROP SHALL BE ADDED TO BRICK MANHOLES.
5. DROP CONNECTION DETAILS ARE BASED ON DUCTILE IRON PIPE AND RESTRAINED FITTINGS WITH MEGA-LUGS.
6. CONNECTIONS TO WASTEWATER MAINS OF OTHER MATERIAL SHALL BE MADE WITH HARCO MATERIAL TRANSITION COUPLING OR APPROVED EQUAL.
7. MINIMUM DISTANCE FROM OUTSIDE OF DROP PIPE TO NEAREST MANHOLE JOINT SHALL BE 6".
8. MINIMUM CLEARANCE FROM OUTSIDE OF DROP PIPE TO MANHOLE WALL SHALL BE 12".
9. SLOPE OF MAIN SEWER LINE APPROACH TO THE DROP ASSEMBLY SHOULD BE NO GREATER THAN 5%.
10. CONTRACTOR SHALL ENSURE CONCRETE THRUST BLOCK IS SUFFICIENTLY CURED PRIOR TO INSTALLATION OF REMAINDER OF DROP ASSEMBLY.

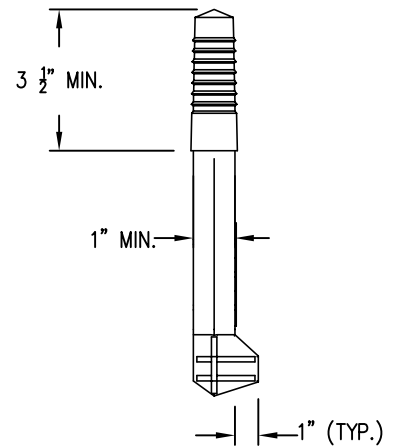


NOTE

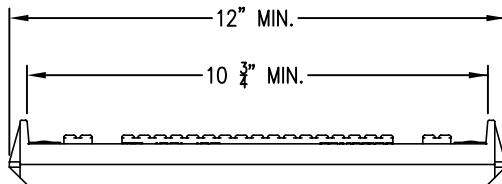
1. THE FLOW CHANNEL STRAIGHT THROUGH A MANHOLE SHALL CONFORM AS CLOSELY AS POSSIBLE IN SHAPE TO THAT OF THE CONNECTING SEWERS AND BE A SMOOTH CONNECTION BETWEEN THE INLET TRIBUTARY AND THE OUTLET PIPE.
2. FLOW CHANNELS BETWEEN AN INLET TRIBUTARY PIPE AND THE OUTLET PIPE MAY BE FIELD CONSTRUCTED OR PRECAST.
3. THE INVERT OF THE PIPE SHALL BE EQUAL TO THE INVERT OF THE FLOW CHANNEL AT THE CONNECTION.
4. THE CHANNEL WALLS SHALL BE FORMED OR SHAPED TO THE FULL HEIGHT OF THE CROWN OF THE OUTLET SEWER IN SUCH A MANNER TO NOT OBSTRUCT MAINTENANCE, INSPECTION OR FLOW IN THE SEWERS AND TO PREVENT SOLIDS DEPOSITION.
5. CURVED FLOW CHANNELS MAY REQUIRE INCREASED CHANNEL SLOPE TO MAINTAIN ACCEPTABLE FLOW VELOCITY.
6. MAXIMUM DIFFERENCE IN ELEVATION BETWEEN THE INVERT OF THE TRIBUTARY INLET AND THE MANHOLE INVERT SHALL BE 18 INCHES. ELEVATION DIFFERENCES GREATER THAN 18 INCHES REQUIRE A DROP MANHOLE.
7. NO TRIBUTARY INLET, INCLUDING SERVICE CONNECTIONS, NOR DROP MANHOLE PIPES SHALL DISCHARGE ONTO THE SURFACE OF THE BENCH.
8. BENCH AND CHANNELS TO BE FORMED USING CONCRETE WITH A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI.
9. CONCRETE SHALL BE TROWELED TO A SMOOTH FINISH.



PLAN



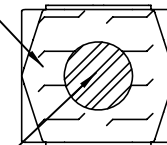
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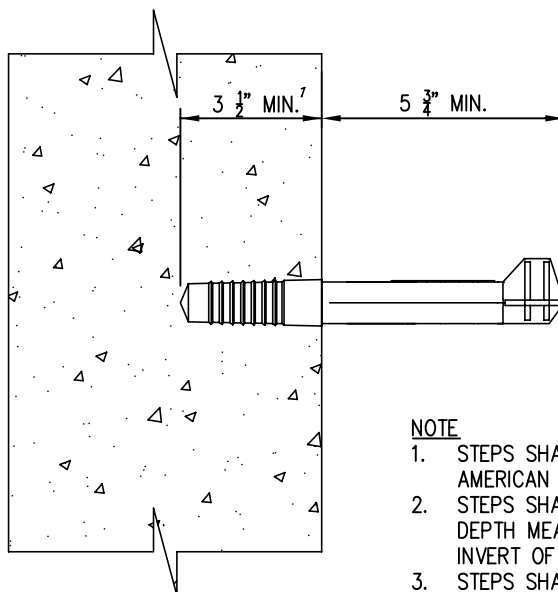
FRONT

COPOLYMER
POLYPROPYLENE
PLASTIC PER ASTM
D4101

1/2" DIA. GRADE 60 STEEL
REINFORCEMENT PER ASTM
A615 POWDER EPOXY
COATED PER ASTM A934

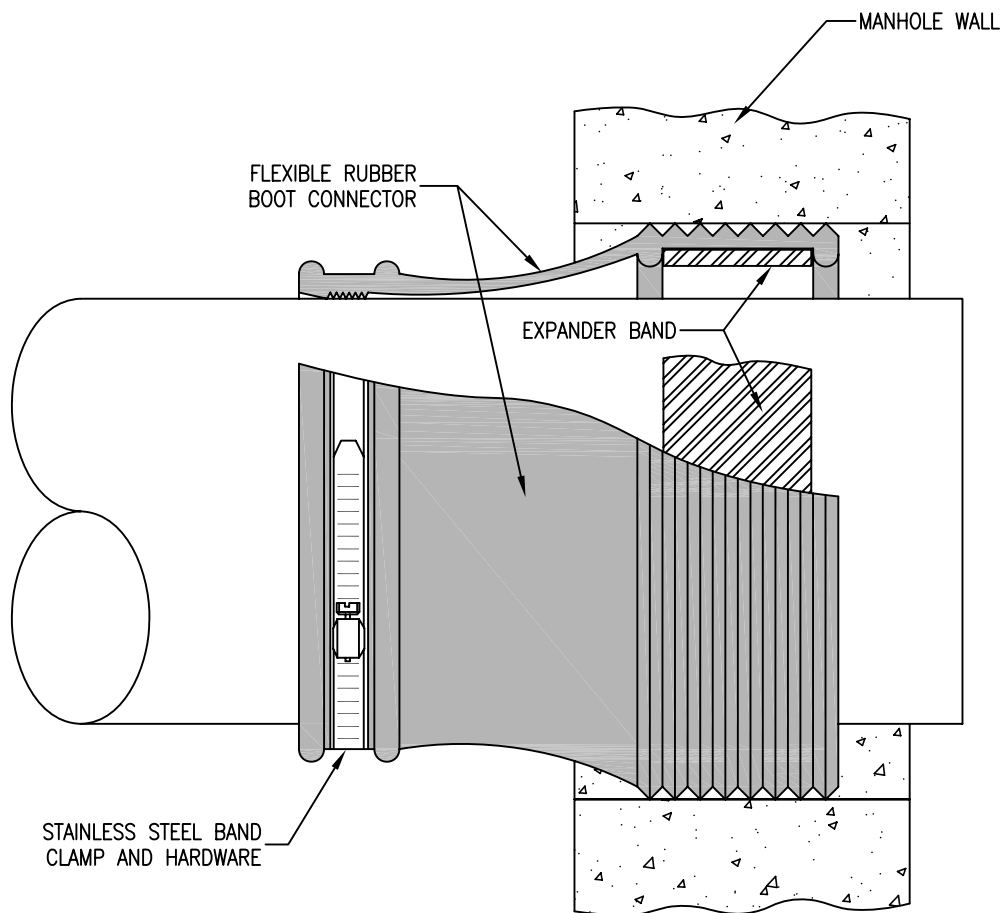


SECTION A-A



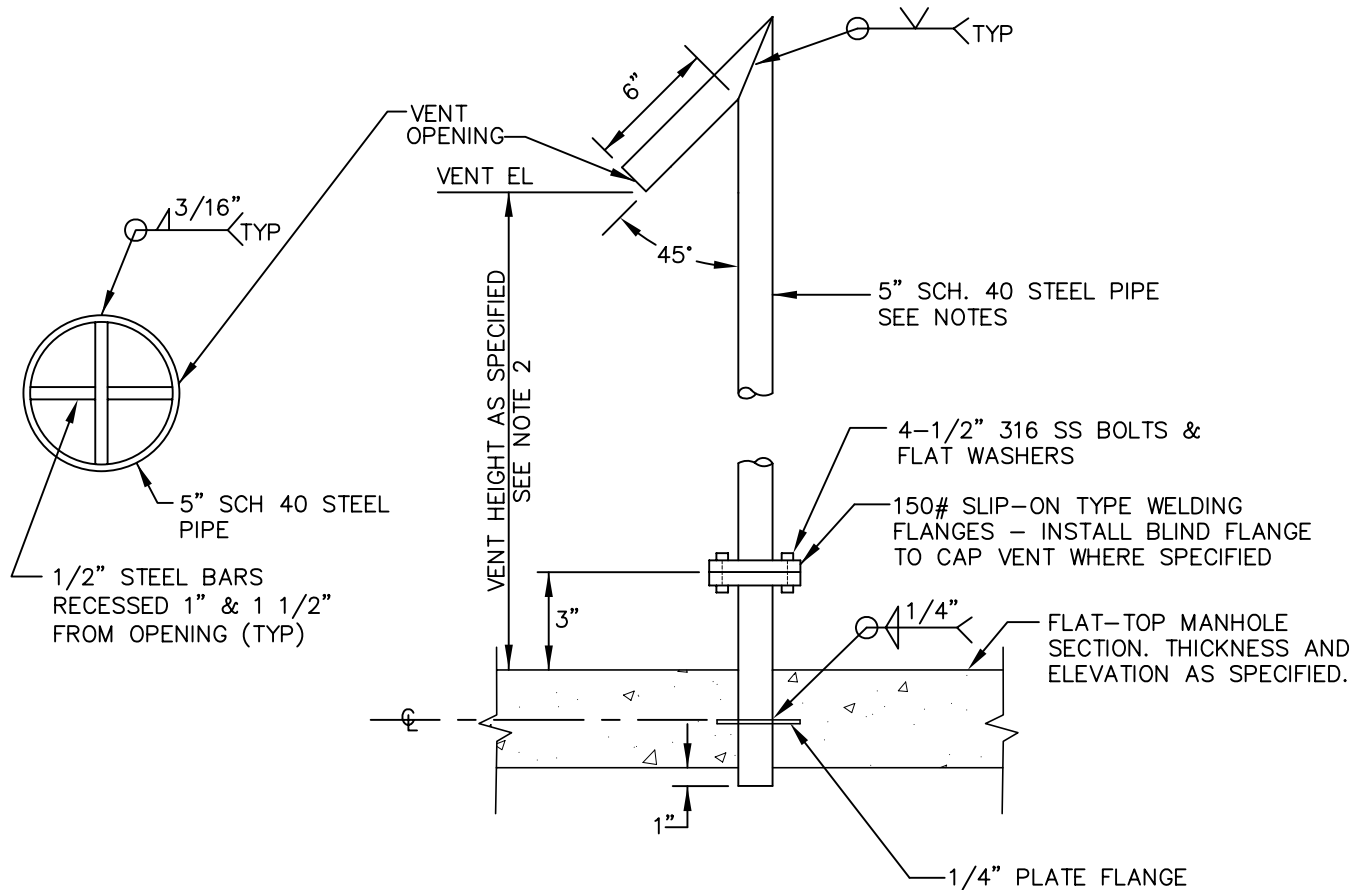
NOTE

1. STEPS SHALL CONFORM TO ASTM C478 AND OSHA STANDARDS. ML 10 BY AMERICAN STEP COMPANY, INC., OR APPROVED EQUAL.
2. STEPS SHALL BE INSTALLED IN ALL STRUCTURES GREATER THAN 4 FEET OF DEPTH MEASURED FROM THE TOP OF THE MANHOLE COVER TO THE LOWEST INVERT OF THE FLOW CHANNEL.
3. STEPS SHALL BE PLACED 12-16 INCHES CENTER TO CENTER ON WALL, AND PROTRUDE A MINIMUM OF 5 3/4 INCHES FROM THE INSIDE FACE OF STRUCTURE WALL. STEP SPACING WITHIN A SINGLE STRUCTURE SHALL BE MAINTAINED WITHIN 1" OF THE AVERAGE STEP SPACING FOR THAT STRUCTURE.
4. STEPS SHALL BE LOCATED TO ALLOW DIRECT ACCESS FROM THE SURFACE TO THE TABLE.



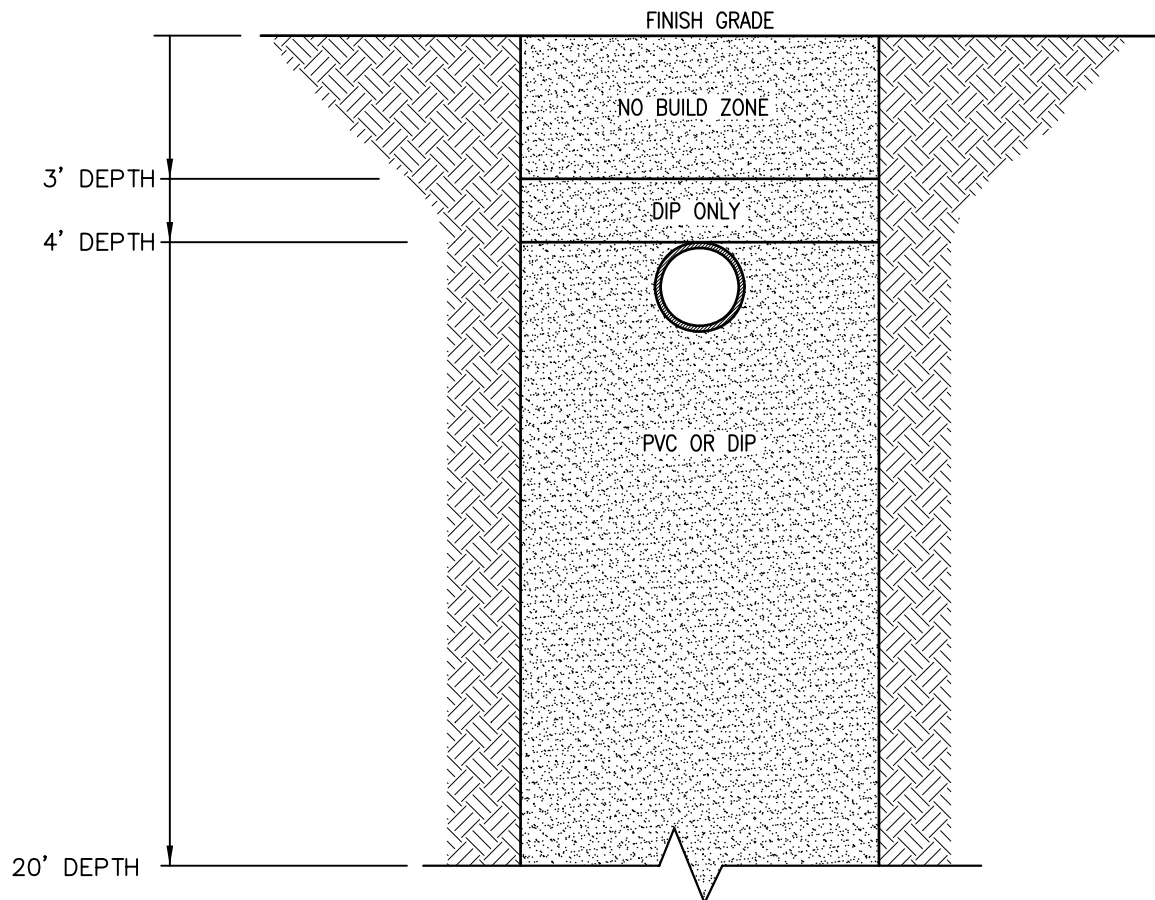
NOTE

1. ALL PIPE CONNECTIONS INTO PRECAST MANHOLES SHALL BE INSTALLED BY CORING AND UTILIZE A FLEXIBLE BOOT SUCH AS KOR-N-SEAL® OR APPROVED EQUAL.
2. THE FLEXIBLE BOOT SHALL BE IN CONFORMANCE WITH THE LATEST CITY STANDARD SPECIFICATIONS AND IN ACCORDANCE WITH ASTM C923, ASTM A666, AND ASTM A240.
3. THE INSTALLED PIPE SHALL HAVE A SMOOTH, FORMED INVERT; BORING OR CHIPPING OF THE EXISTING TABLE TO THE FLOW CHANNEL IS REQUIRED.
4. CORINGS FOR BOOT CONNECTORS SHALL NOT BE MADE WITHIN SIX INCHES OF A MANHOLE BARREL SECTION JOINT.
5. OTHER THAN PRECAST CONCRETE MANHOLES AND WITHOUT THE WRITTEN APPROVAL OF THE CITY ENGINEER, EXISTING MANHOLES MAY NOT BE CORED.
6. RE-CORING OR OVER CORING AN EXISTING CONNECTION MAY NOT BE ACCEPTED BY THE CITY AND SHOULD BE AVOIDED.



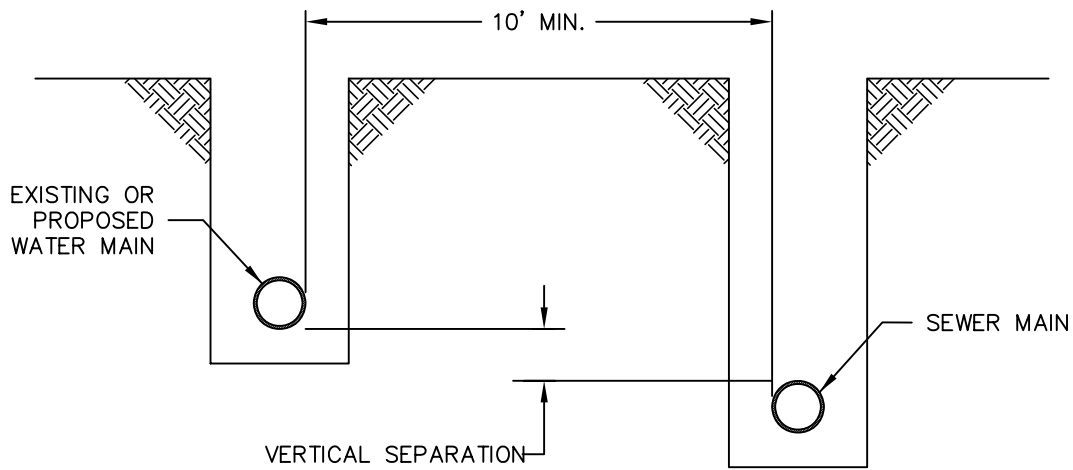
NOTE

1. FIVE INCH DIAMETER FLANGED BY PLAIN END STEEL WALL PIPE SHALL BE CAST IN PLACE (PLUMB) WITH BOLT HOLES IN FLANGE STRADDLING THE CENTER LINES. PIPE TO BE COATED PER VENT PIPE SPECIFICATIONS.
2. FIVE INCH DIAMETER STEEL VENT PIPE TO BE FURNISHED WITH COMPATIBLE FLANGE AND ALL NECESSARY STAINLESS STEEL HARDWARE FOR BOLTED ATTACHMENT.
3. VENT OUTLET TO POINT DOWNSTREAM.
4. PROVIDE SCREEN ON END OF VENT PIPES. SCREEN TO BE MADE OF 2 STEEL BARS WELDED TO INSIDE OF PIPE.
5. ALL STEEL COMPONENTS SHALL BE HOT DIP GALVANIZED AFTER FABRICATION AND BEFORE BEING CAST-IN-PLACE.
6. TOP OF VENT OPENING TO BE 2 FEET ABOVE THE 100-YEAR FLOOD ELEVATION. IF MANHOLE COVER/TOP SLAB IS ABOVE 100-YEAR FLOOD ELEVATION, VENT OPENING TO BE 2 FEET ABOVE TOP SLAB.
7. VENTS TO BE INSTALLED EVERY 1,000 FEET OR AS APPROVED BY THE CITY ENGINEER.



NOTE

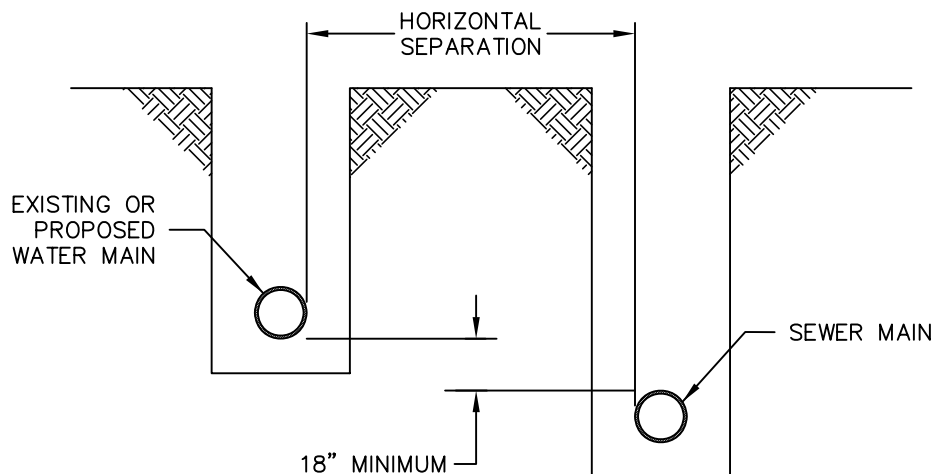
1. COVER DEPTH SHALL BE MEASURED FROM FINISHED GRADE SURFACE TO THE TOP OF PIPE.
2. INSTALLATIONS DEEPER THAN 20 FEET REQUIRE DUCTILE IRON PIPE (DIP) AND PRIOR APPROVAL BY THE CITY ENGINEER. BURIAL DEPTHS LESS THAN 3.0 FEET WILL NOT BE PERMITTED.
3. POLY VINYL CHLORIDE (PVC) SEWER PIPE SHALL BE SDR 26 OR SDR 35 MEETING ASTM D3034 FOR 4" TO 15" DIAMETER PIPE OR ASTM F679 FOR 18" TO 36" DIAMETER PIPE. PIPE SHALL BE MADE FROM PVC COMPOUNDS HAVING A CELL CLASSIFICATION OF 12454B AS DEFINED IN ASTM D1784. PIPE SHALL INCORPORATE AN INTEGRAL BELL JOINT WITH A SINGLE RUBBER GASKET CONFORMING TO ASTM F477. JOINTS SHALL BE IN ACCORDANCE WITH ASTM D3212, AND BE FURNISHED COMPLETE WITH ALL NECESSARY ACCESSORIES. PIPE, FITTINGS AND ACCESSORIES SHALL BE IN CONFORMANCE WITH CITY SPECIFICATIONS.
4. DIP SEWER PIPE SHALL BE ASPHALT COATED CEMENT MORTAR LINED CLASS 50 DUCTILE IRON PIPE. DIP SHALL BE PRESSURE CLASS 150. DIP SHALL BE DESIGNED AND MANUFACTURED IN ACCORDANCE WITH ANSI/AWWA C150/A21.50 AND C151/A21.51. PIPE SHALL HAVE A STANDARD 1-MIL ASPHALTIC COATING APPLIED ON THE EXTERIOR OF THE PIPE IN ACCORDANCE WITH ANSI/AWWA C151/A21.51. PIPE SHALL ALSO HAVE A CEMENT-MORTAR LINING ON THE INTERIOR IN ACCORDANCE WITH ANSI/AWWA C104/A21.4. ALL PIPE SHALL BE FURNISHED WITH PUSH-ON TYPE JOINTS, SUCH AS TYTON® OR FASTITE®. JOINTS SHALL BE IN ACCORDANCE WITH ANSI/AWWA C111/A21.11, AND BE FURNISHED COMPLETE WITH ALL NECESSARY ACCESSORIES. PIPE, FITTINGS AND ACCESSORIES SHALL BE IN CONFORMANCE WITH CITY SPECIFICATIONS.
5. WHEN SOIL TESTS IN ACCORDANCE WITH APPENDIX A OF ANSI/AWWA C105/A21.5 AND/OR PERFORMANCE HISTORY INDICATE THAT CONDITIONS ARE CORROSIVE TO DIP, POSITIVE CORROSION PROTECTION IS REQUIRED IN ACCORDANCE WITH CITY SPECIFICATIONS.
6. WHEN DIP IS USED TO TRANSPORT SEPTIC SEWAGE, SPECIALLY LINED PIPE IS REQUIRED IN ACCORDANCE WITH CITY SPECIFICATIONS.



TYPICAL INSTALLATION
(MINIMUM 10' HORIZONTAL SEPARATION)

NOTE

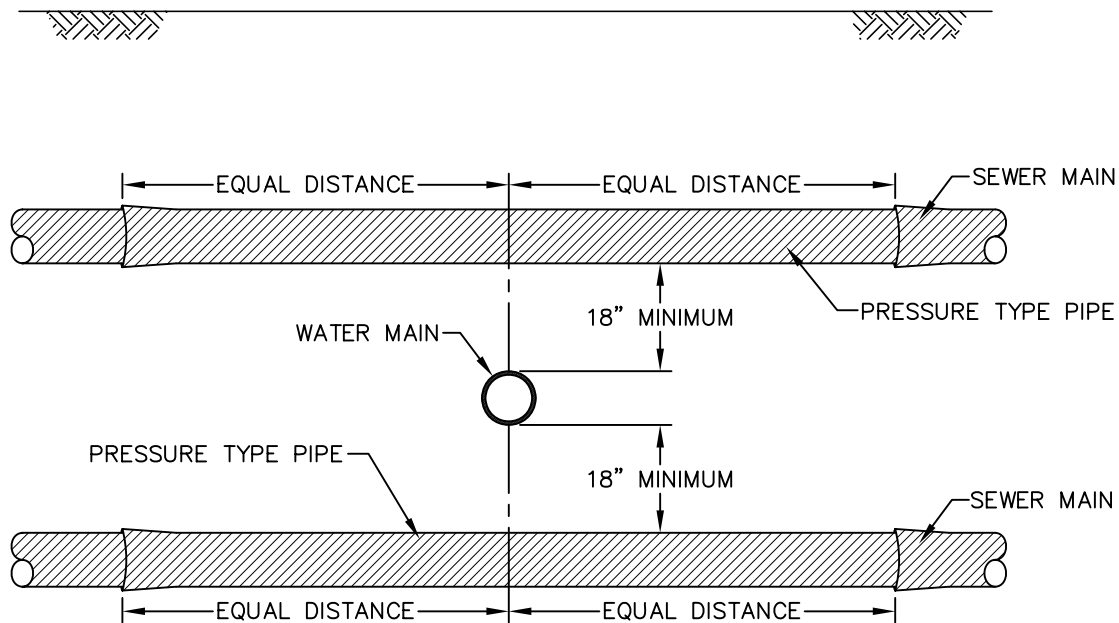
1. THERE ARE NO VERTICAL SEPARATION REQUIREMENTS WHEN HORIZONTAL SEPARATION IS 10' OR GREATER.



INSTALLATION WHERE HORIZONTAL SEPARATION IS LESS THAN 10'
(USED ONLY WHEN LOCAL CONDITIONS PREVENT TYPICAL INSTALLATION)

NOTE

1. THE SEWER MUST BE LAID IN A SEPARATE TRENCH FROM THE WATER.
2. THE TOP OF THE SEWER MAIN MUST BE A MINIMUM OF 18" BELOW THE BOTTOM OF THE WATER MAIN.
3. WHERE THE MINIMUM 18" SEPARATION CANNOT BE OBTAINED, THE FOLLOWING SPECIFICATIONS APPLY:
 - A. ALL REASONABLE EFFORT MUST BE MADE FOR THE SEWER LINE TO BE LOCATED UNDER THE WATER MAIN.
 - B. SEWER MAIN SHALL BE CONSTRUCTED OF SLIP TYPE OR MECHANICAL JOINT PIPE COMPLYING WITH ANSI/AWWA C900 OR ANSI/AWWA C600, PUBLIC WATER SUPPLY STANDARDS FROM NEAREST UPSTREAM MANHOLE TO THE NEAREST DOWNSTREAM MANHOLE.
 - C. ENTIRE LINE SHALL BE PRESSURE TESTED IN PLACE TO 150 PSI TO ASSURE WATER TIGHTNESS PRIOR TO BACKFILLING.
 - D. THIS SECTION OF THE SEWER LINE SHALL ALSO BE PRESSURE TESTED IN ACCORDANCE WITH CITY SPECIFICATIONS ALONG WITH THE REMAINDER OF THE SEWER SYSTEM.

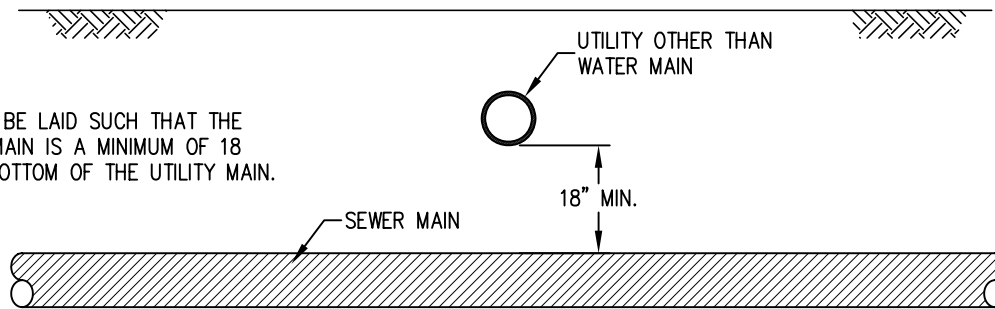


NOTE

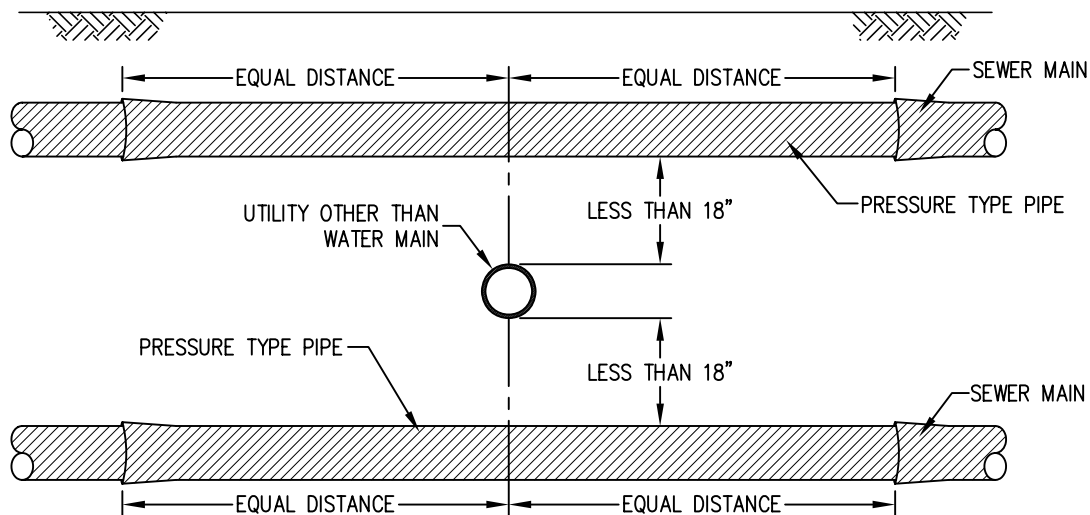
1. ALL REASONABLE EFFORT MUST BE MADE FOR THE SEWER LINE TO CROSS UNDER THE WATER MAIN.
2. THE SEWER SHALL BE LAID SUCH THAT THE OUTSIDE EDGE OF THE SEWER MAIN IS A MINIMUM OF 18 INCHES FROM THE OUTSIDE EDGE OF THE WATER MAIN.
3. THE CROSSING SHALL BE ARRANGED SO THAT THE SEWER JOINTS WILL BE EQUIDISTANT AND AS FAR AS POSSIBLE FROM THE WATER MAIN JOINTS.
4. SEWER MAIN SHALL BE CONSTRUCTED OF SLIP TYPE OR MECHANICAL JOINT PIPE COMPLYING WITH ANSI/AWWA C900 OR ANSI/AWWA C600, PUBLIC WATER SUPPLY STANDARDS FROM NEAREST UPSTREAM MANHOLE TO THE NEAREST DOWNSTREAM MANHOLE.
5. ENTIRE LINE SHALL BE PRESSURE TESTED IN PLACE TO 150 PSI TO ASSURE WATER TIGHTNESS PRIOR TO BACKFILLING.
6. THIS SECTION OF THE SEWER LINE SHALL ALSO BE PRESSURE TESTED IN ACCORDANCE WITH CITY SPECIFICATIONS ALONG WITH THE REMAINDER OF THE SEWER SYSTEM.
7. THE CROSSING SHALL HAVE ADEQUATE STRUCTURAL SUPPORT TO PREVENT DAMAGE TO THE MAIN.

NOTE

1. THE SEWER SHALL BE LAID SUCH THAT THE TOP OF THE SEWER MAIN IS A MINIMUM OF 18 INCHES BELOW THE BOTTOM OF THE UTILITY MAIN.



TYPICAL INSTALLATION
(SEWER MAIN CROSSING UNDER UTILITY OTHER THAN WATER MAIN)



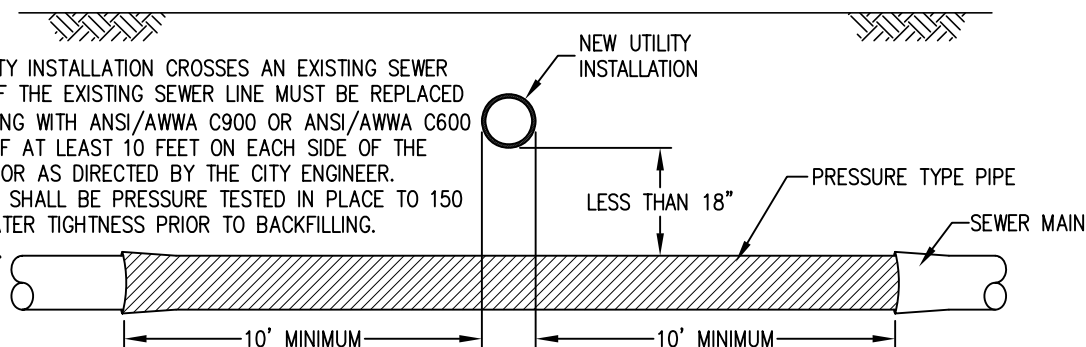
INSTALLATION WHERE VERTICAL SEPARATION IS LESS THAN 18"
(USED ONLY WHEN LOCAL CONDITIONS PREVENT TYPICAL INSTALLATION)

NOTE

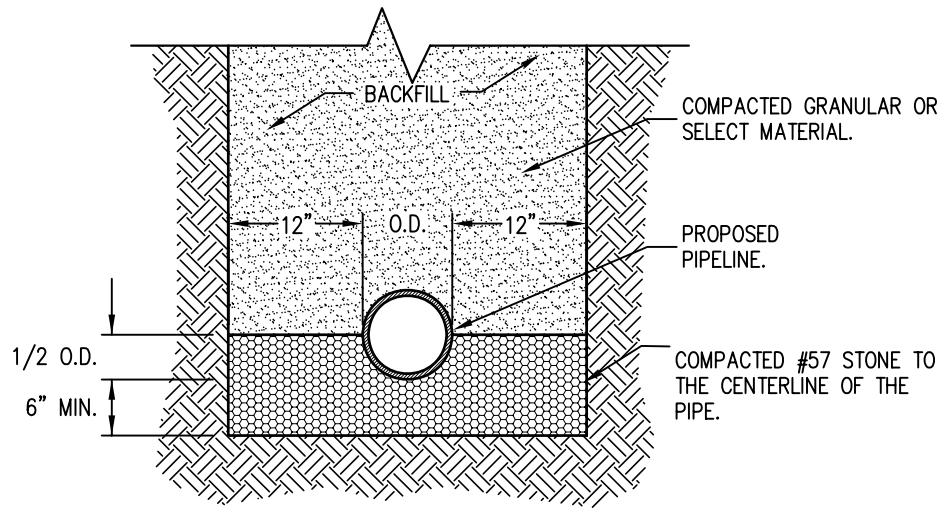
1. SEWER MAIN SHALL BE CONSTRUCTED OF SLIP TYPE OR MECHANICAL JOINT PIPE COMPLYING WITH ANSI/AWWA C900 OR ANSI/AWWA C600, PUBLIC WATER SUPPLY STANDARDS FROM NEAREST UPSTREAM MANHOLE TO THE NEAREST DOWNSTREAM MANHOLE.
2. ENTIRE LINE SHALL BE PRESSURE TESTED IN PLACE TO 150 PSI TO ASSURE WATER TIGHTNESS PRIOR TO BACKFILLING.
3. THIS SECTION OF THE SEWER LINE SHALL ALSO BE PRESSURE TESTED IN ACCORDANCE WITH CITY SPECIFICATIONS ALONG WITH THE REMAINDER OF THE SEWER SYSTEM.
4. THE CROSSING SHALL HAVE ADEQUATE STRUCTURAL SUPPORT TO PREVENT DAMAGE TO THE MAIN.
5. THE CROSSING SHALL BE ARRANGED SO THAT THE SEWER JOINTS WILL BE EQUIDISTANT AND AS FAR AS POSSIBLE FROM THE UTILITY MAIN JOINTS.

NOTE

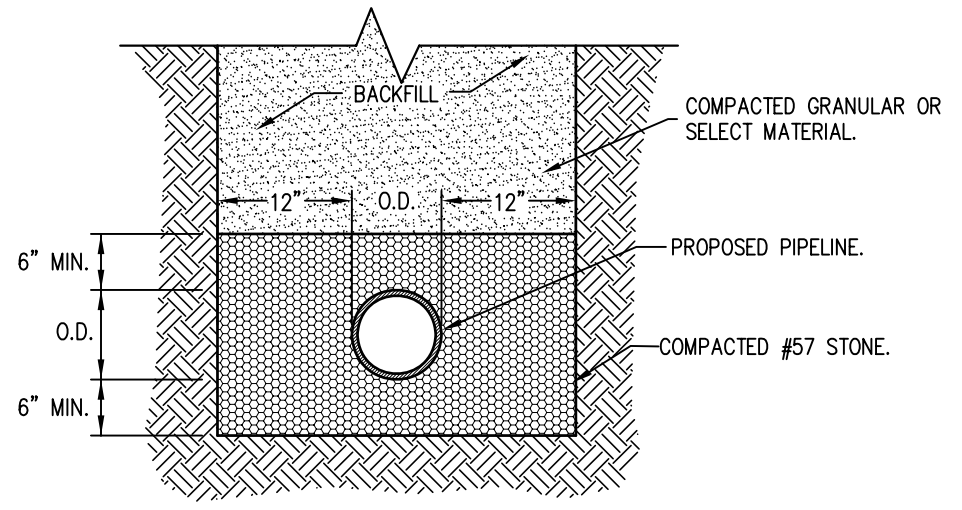
1. WHEN A NEW UTILITY INSTALLATION CROSSES AN EXISTING SEWER LINE, A SECTION OF THE EXISTING SEWER LINE MUST BE REPLACED WITH PIPE COMPLYING WITH ANSI/AWWA C900 OR ANSI/AWWA C600 FOR A DISTANCE OF AT LEAST 10 FEET ON EACH SIDE OF THE CROSSING UTILITY, OR AS DIRECTED BY THE CITY ENGINEER.
2. REPLACED SECTION SHALL BE PRESSURE TESTED IN PLACE TO 150 PSI TO ASSURE WATER TIGHTNESS PRIOR TO BACKFILLING.
3. NOTES 3-5 ABOVE.



NEW UTILITY MAIN INSTALLATION
(USED ONLY WHEN LOCAL CONDITIONS PREVENT 18" MINIMUM CLEARANCE)



DUCTILE IRON PIPE



PVC PIPE

NOTE

1. CONTRACTOR SHALL NOTIFY CITY OF GREENVILLE CONSTRUCTION INSPECTION BUREAU A MINIMUM OF 72 HOURS PRIOR TO BEGINNING CONSTRUCTION ACTIVITIES.
2. PVC PIPE SHALL BE INSTALLED AS SHOWN AND IN CONFORMANCE WITH THE LATEST CITY SPECIFICATIONS AND IN ACCORDANCE WITH ASTM D2321.
3. DUCTILE IRON PIPE SHALL BE INSTALLED AS SHOWN AND IN CONFORMANCE WITH THE LATEST CITY SPECIFICATIONS AND IN ACCORDANCE WITH SECTIONS 4.3.1 THROUGH 4.3.5 (EXCEPT 4.3.3.5, 4.3.4.4, AND 4.3.5.1.1), 5.1.1, AND 6.1 OF ANSI/AWWA C600 AS WELL AS THE APPLICABLE PORTIONS ASTM D2321 FOR NON-RIGID PIPE INSTALLATION.
4. EACH SECTION OF SEWER PIPE SHALL BE LAID TO THE APPROPRIATE LINE AND GRADE, AS DESIGNED AND PERMITTED, WORKING IN THE UPSTREAM DIRECTION WITH THE BELL END LAID UPGRADE.
5. TRENCH BOTTOM, PIPE BEDDING, AND ALL OTHER PLACEMENT AND COMPACTION OPERATIONS SHALL BE INSPECTED BY THE CITY OF GREENVILLE CONSTRUCTION INSPECTION BUREAU IN ACCORDANCE WITH CITY SPECIFICATIONS.
6. AS REQUESTED, THE CONTRACTOR SHALL SUPPLY RELIABLE TESTING DATA CONFIRMING THE MINIMUM STANDARDS ARE MET. THE CITY MAY NOT ACCEPT WORK IF THE CONTRACTOR FAILS TO PRODUCE SUFFICIENT TESTING RESULTS.
7. ALL TRENCH WORK SHALL BE IN COMPLIANCE WITH THE LATEST EDITION OF OSHA PART 1926 SUBPART P APPENDIX B OF THE CODE OF FEDERAL REGULATIONS.
8. TRENCH WIDTHS SHALL BE WIDER TO PERMIT THE PLACEMENT OF TIMBER SUPPORTS, SHEETING, BRACING, AND APPURTENANCES AS REQUIRED BY OSHA REGULATIONS.
9. TRENCH BOTTOM SHALL BE FREE OF WATER BEFORE PLACEMENT OF BEDDING.
10. UNSUITABLE SOIL SHALL BE REMOVED & BACKFILLED WITH APPROVED STONE AS DIRECTED BY THE CITY OF GREENVILLE CONSTRUCTION INSPECTION BUREAU.
11. CONTRACTOR SHALL SHAPE RECESSES BY HAND FOR PIPE BELL.
12. WHEN PLACED WITHIN THE R/W AND ALL TRAVELED SURFACES, BACKFILL MATERIAL SHALL BE CLEAN, SELECT MATERIAL PLACED IN 6" LIFTS & COMPACTED TO 95% STANDARD PROCTOR DENSITY PER ASTM D698.
13. WHEN PLACED OUTSIDE THE R/W, BACKFILL MATERIAL SHALL BE CLEAN, SELECT MATERIAL COMPACTED TO 90% STANDARD PROCTOR DENSITY PER ASTM D698.
14. COMPACTION TESTING SHALL BE PERFORMED PER CITY OF GREENVILLE SPECIFICATIONS.
15. SELECT BACKFILL MATERIAL IS NATIVE SOIL EXCAVATED FROM THE TRENCH FREE OF ROCKS, FOREIGN MATERIAL, AND FROZEN EARTH. UNSUITABLE NATIVE SOIL SHALL NOT BE USED.
16. PIPE SHALL RECEIVE A MINIMUM 36" OF COVER BEFORE ALLOWING VEHICLES OR CONSTRUCTION EQUIPMENT TO TRAFFIC THE TRENCH SURFACE AND AT LEAST 48" OF COVER BEFORE USING A HYDROHAMMER FOR COMPACTION.

ASPHALT SURFACE REPAIR

1. SEAL SAW CUT EDGE WITH CRS-2 ASPHALT EMULSION, OR APPROVED EQUAL, PRIOR TO PLACING NEW PAVING.
2. SURFACE COURSE SHALL BE 220#/SYD (2") HOT LAID ASPHALT CONCRETE SURFACE COURSE SCDOT TYPE C.
3. BINDER COURSE DEPTH SHALL MATCH EXISTING PAVEMENT DEPTH BUT A MINIMUM OF 4" HOT LAID ASPHALT CONCRETE BINDER COURSE SCDOT TYPE C PLACED IN MAXIMUM 2" LIFTS.

EXISTING ASPHALT SURFACE

12" UNDISTURBED SOIL BASE

SLOPE TRENCH BANKS PER OSHA REGULATIONS.

CONCRETE SURFACE REPAIR

1. MINIMUM SCDOT CLASS 4000 PORTLAND CEMENT CONCRETE FOR PATCHING.
2. EXPANSION AND CONTRACTION JOINTS SHALL BE PLACED TO MATCH EXISTING.
3. JOINTS SHALL BE EITHER TROWLED OR SAW CUT TO MATCH EXISTING CONDITIONS.
4. BROOM FINISH TO MATCH EXISTING. LARGE PATCHING AREAS MAY REQUIRE SURFACE TEXTURING PER SCDOT SPECIFICATIONS.

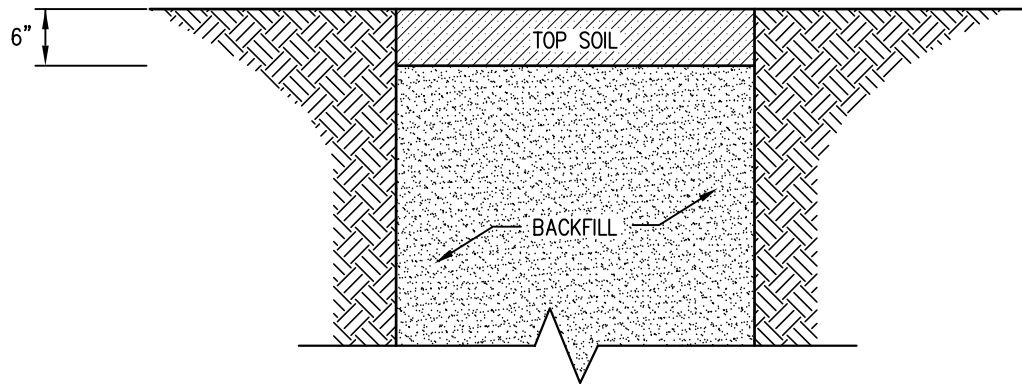
EXISTING CONCRETE SURFACE

12" UNDISTURBED SOIL BASE

COMPACTED GRANULAR OR SELECT MATERIAL.

NOTE

1. CONTRACTOR SHALL NOTIFY CITY OF GREENVILLE CONSTRUCTION INSPECTION BUREAU A MINIMUM OF 72 HOURS PRIOR TO BEGINNING CONSTRUCTION ACTIVITIES.
2. AS REQUESTED, THE CONTRACTOR SHALL SUPPLY RELIABLE TESTING DATA CONFIRMING THE MINIMUM STANDARDS ARE MET. THE CITY MAY NOT ACCEPT WORK IF THE CONTRACTOR FAILS TO PRODUCE SUFFICIENT TESTING RESULTS.
3. TRENCHES SHALL BE PROOF-ROLLED IN THE PRESENCE OF THE CITY TO VERIFY COMPACTION PRIOR TO PLACING PAVEMENT.
4. ALL TRENCH WORK SHALL BE IN COMPLIANCE WITH THE LATEST EDITION OF OSHA PART 1926 SUBPART P APPENDIX B OF THE CODE OF FEDERAL REGULATIONS.
5. WITHIN THE R/W AND ALL TRAVELED SURFACES, BACKFILL MATERIAL SHALL BE CLEAN, SELECT MATERIAL PLACED IN 6" LIFTS & COMPACTED TO 95% STANDARD PROCTOR DENSITY PER ASTM D698. COMPACTION TESTING SHALL BE PERFORMED PER CITY OF GREENVILLE SPECIFICATIONS.
6. SELECT BACKFILL MATERIAL IS NATIVE SOIL EXCAVATED FROM THE TRENCH FREE OF ROCKS, FOREIGN MATERIAL, AND FROZEN EARTH. UNSUITABLE NATIVE SOIL SHALL NOT BE USED.
7. UNSUITABLE SOIL SHALL BE REMOVED & BACKFILLED WITH APPROVED STONE AS DIRECTED BY THE CITY OF GREENVILLE CONSTRUCTION INSPECTION BUREAU.
8. ALL EDGES IN PAVED AREAS SHALL BE FULL DEPTH SAW CUT. ALL CUTS SHALL BE NEAT, CLEAN & STRAIGHT.
9. IF TOP WIDTH OF TRENCH(S) EXCEEDS 50% OF THE TOTAL ROAD WIDTH, FULL DEPTH REPLACEMENT OF THE ENTIRE ROADWAY SHALL BE REQUIRED FOR THE LENGTH OF THE TRENCH(S).
10. IF TOP WIDTH OF TRENCH(S) EXCEEDS 50% OF THE WIDTH OF ANY TRAVEL LANE, FULL DEPTH REPLACEMENT OF THE ENTIRE IMPACTED TRAVEL LANE SHALL BE REQUIRED.
11. IF DISTANCE BETWEEN EDGE OF PATCH & EXISTING EDGE OF PAVEMENT IS LESS THAN ONE FOOT, ROAD PATCH SHALL BE EXTENDED TO EDGE OF EXISTING PAVEMENT.
12. ALL PATCHES SHALL BE SMOOTH AND LEVEL (+/- 1/4") WITH EXISTING SURFACE.
13. CONCRETE SHALL BE A MINIMUM DESIGN OF SCDOT CL4000. CONTRACTOR SHALL MAINTAIN STREET UNTIL CONCRETE HAS SUFFICIENT STRENGTH TO SUPPORT FINAL PAVING INSTALLATION. HIGH EARLY STRENGTH CONCRETE MAY BE USED.
14. TRAFFIC CONTROL SHALL BE PROVIDED PER THE LATEST EDITION OF THE MUTCD. SUBMITTAL AND APPROVAL OF A TRAFFIC CONTROL PLAN BY THE CONSTRUCTION INSPECTION BUREAU IS REQUIRED FOR STREETS WITH MORE THAN 400 VEHICLES PER DAY.
15. EXISTING PAVEMENT SECTION INCLUDES ALL PAVEMENT LAYERS FROM FINISH GRADE TO EXISTING SUBGRADE.
16. ALL WORK SHALL COMPLY WITH CITY OF GREENVILLE AND SCDOT SPECIFICATIONS.



NOTE

1. CONTRACTOR SHALL NOTIFY CITY OF GREENVILLE CONSTRUCTION INSPECTION BUREAU A MINIMUM OF 72 HOURS PRIOR TO BEGINNING CONSTRUCTION ACTIVITIES.
2. AS REQUESTED, THE CONTRACTOR SHALL SUPPLY RELIABLE TESTING DATA CONFIRMING THE MINIMUM STANDARDS ARE MET. THE CITY MAY NOT ACCEPT WORK IF THE CONTRACTOR FAILS TO PRODUCE SUFFICIENT TESTING RESULTS.
3. ALL TRENCH WORK SHALL BE IN COMPLIANCE WITH THE LATEST EDITION OF OSHA PART 1926 SUBPART P APPENDIX B OF THE CODE OF FEDERAL REGULATIONS.
4. WITHIN THE R/W, TRENCHES SHALL BE PROOF-ROLLED IN THE PRESENCE OF THE CITY TO VERIFY COMPACTION PRIOR TO PLACING FINAL SOIL LIFT WITHIN THE RIGHT-OF-WAY.
5. WITHIN THE R/W, BACKFILL MATERIAL SHALL BE CLEAN, SELECT MATERIAL PLACED IN 6" LIFTS & COMPACTED TO 95% STANDARD PROCTOR DENSITY PER ASTM D698.
6. OUTSIDE THE R/W, BACKFILL MATERIAL SHALL BE CLEAN, SELECT MATERIAL COMPACTED TO 90% STANDARD PROCTOR DENSITY PER ASTM D698.
7. COMPACTION TESTING SHALL BE PERFORMED PER CITY OF GREENVILLE SPECIFICATIONS.
8. SELECT BACKFILL MATERIAL IS NATIVE SOIL EXCAVATED FROM THE TRENCH FREE OF ROCKS, FOREIGN MATERIAL, AND FROZEN EARTH. UNSUITABLE NATIVE SOIL SHALL NOT BE USED.
9. UNSUITABLE SOIL SHALL BE REMOVED & BACKFILLED MATERIAL AS DIRECTED BY THE CITY OF GREENVILLE CONSTRUCTION INSPECTION BUREAU.
10. THE TOP 6" LIFT SHALL BE SCREENED, ORGANIC TOP SOIL.
11. TRENCH SHALL BE STABILIZED IMMEDIATELY PER SCDOT GRASSING SCHEDULE OR AS DIRECTED BY CITY OF GREENVILLE CONSTRUCTION INSPECTION BUREAU.
12. EXISTING LANDSCAPING REMOVED OR DESTROYED AS PART OF THE UTILITY INSTALLATION SHALL BE REPLACED WITH SAME MATERIALS.
13. ALL WORK SHALL COMPLY WITH CITY OF GREENVILLE AND SCDOT SPECIFICATIONS.



UNPAVED SURFACE REPAIR FOR UTILITY CUTS

DATE
APPROVED: JUNE 2010

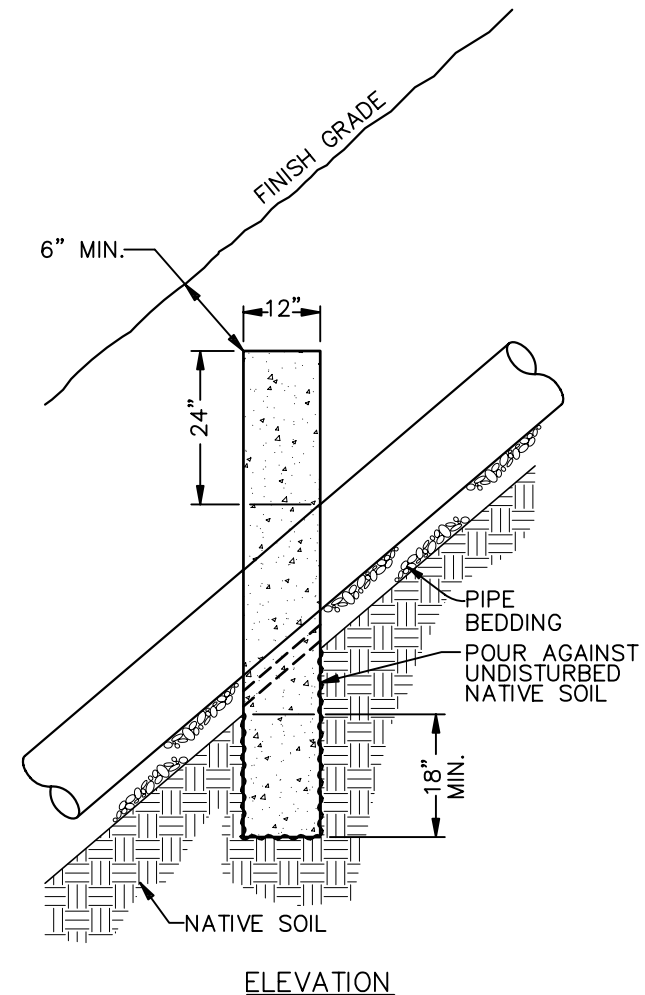
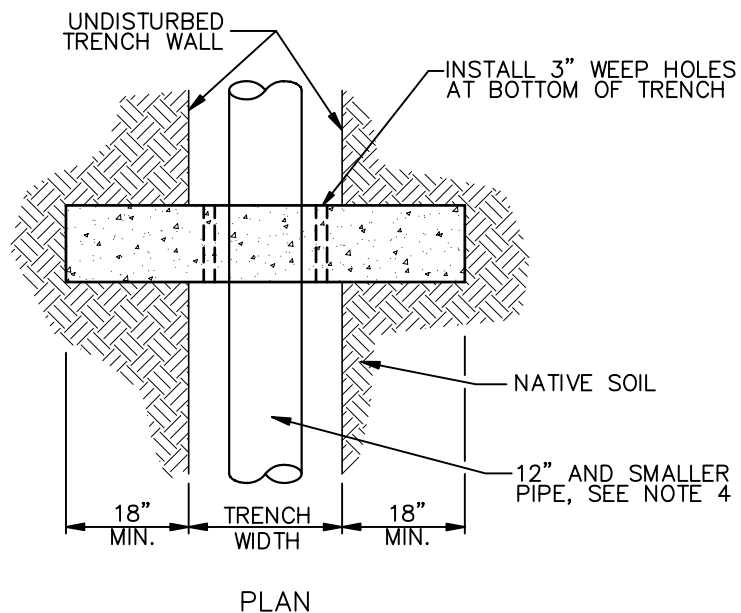
OFFICE OF THE
CITY ENGINEER:

Philip B. Lindsey

SCALE:
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DETAIL :

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NOTE

1. POURED IN PLACE CONCRETE PIPE ANCHORS SHALL BE CONSTRUCTED WHEN PIPELINES ARE INSTALLED WITH SLOPES 20% AND GREATER.
2. CONCRETE SHALL BE SUFFICIENTLY CURED AND ALL FORMWORK SHALL BE REMOVED PRIOR TO BACKFILLING TRENCH.
3. ALL CONCRETE SHALL BE MINIMUM 3000 PSI.
4. DIMENSIONS SHOWN HEREIN ARE FOR PIPELINES 12" AND LESS IN DIAMETER. DESIGN EMBEDMENT FOR PIPES LARGER THAN 12" SHALL BE REVIEWED BY THE CITY ENGINEER.
5. ANCHORS SHALL NOT BE PLACED WITHIN 6" OF PIPE JOINT.
6. MAXIMUM CENTER TO CENTER SPACING OF CONCRETE PIPE ANCHORS SHALL BE:

PIPE SLOPE (PERCENT)	20-34.9	35-49.9	50 & UP
MAX. CENTER TO CENTER SPACING (FT)	36'	24'	16'


**city of
greenville**
 ENGINEERING DIVISION

CONCRETE ANCHOR

DATE APPROVED: JUNE 2010

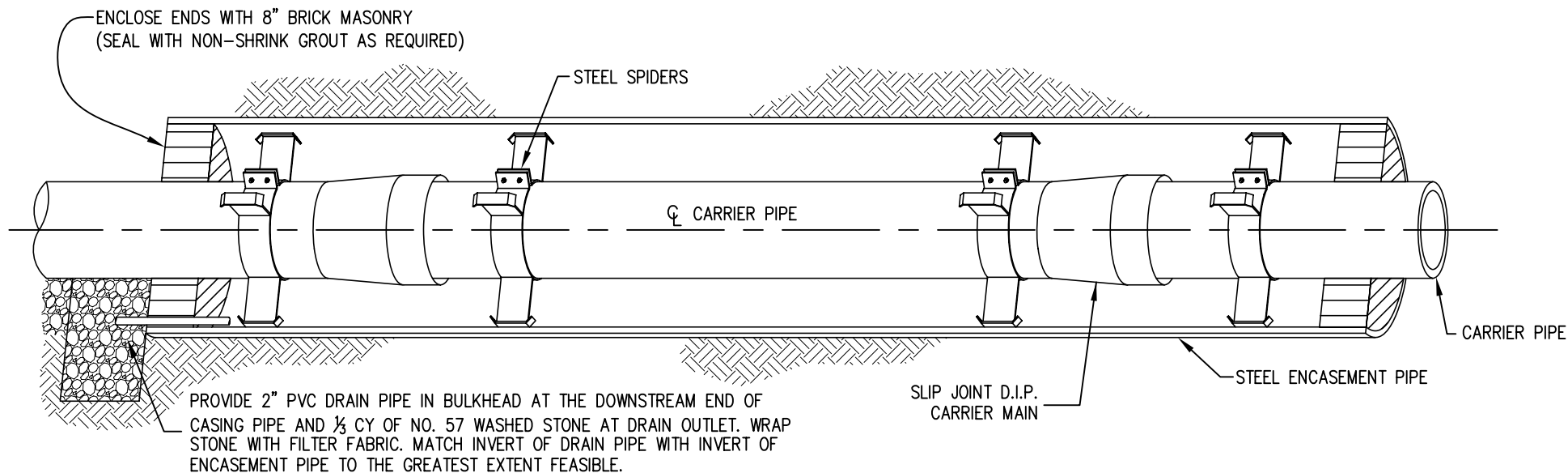
OFFICE OF THE
CITY ENGINEER:

Philip B. Lindsey

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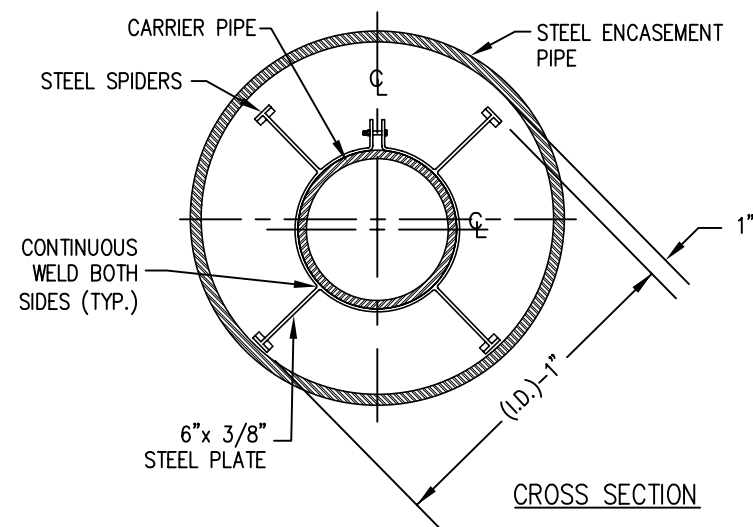
DETAIL:

24:00



NOTE

1. STEEL CASING PIPE SHALL BE TYPE S, GRADE B, PLAIN AND BEVELED, WITH A MINIMUM YIELD STRENGTH OF 35,000 PSI AND MANUFACTURED IN ACCORDANCE WITH ASTM A53.
2. STEEL CASING PIPE SHALL BE FURNISHED IN 20' LENGTHS AND ALL JOINTS SHALL BE WELDED IN ACCORDANCE WITH AWWA C206.
3. STEEL CASING PIPE SHALL HAVE MINIMUM WALL THICKNESS AND CATHODICALLY PROTECTED PER CITY OF GREENVILLE SPECIFICATIONS.
4. TO THE SATISFACTION OF THE CITY INSPECTOR, THE CASING PIPE SHALL BE CERTIFIED TO BE TO THE LINE AND GRADE AS SHOWN ON THE APPROVED PLANS PRIOR TO INSTALLING THE CARRIER PIPE.
5. 316 STAINLESS STEEL OR GALVANIZED STEEL WITH COAL TAR EPOXY SPACING "SPIDERS" BY SPIDER MANUFACTURING, INC., OR APPROVED EQUAL, SHALL BE USED FOR SUPPORT OF THE CARRIER PIPE WITHIN THE CASING PIPE.
6. ALL NUTS, BOLTS AND WASHERS SHALL BE 316 STAINLESS STEEL.
7. THE SPACERS SHALL SUPPORT THE FULL LOAD OF THE CARRIER PIPE TO PREVENT DEFLECTION AND MISALIGNMENT. A MINIMUM SPACING OF 2 SPIDERS PER JOINT OF CARRIER PIPE SHALL BE REQUIRED. ADDITIONAL SPIDERS MAY BE REQUIRED TO SUPPORT THE PIPE AND WASTEWATER.
8. THE SPIDERS SHALL BE SPACED EVENLY ALONG THE CARRIER PIPE SUCH THAT EACH SPIDER SUPPORTS APPROXIMATELY THE SAME UNIT WEIGHT OF THE CARRIER MAIN.
9. THE HEIGHT OF EACH SPIDER SHALL BE DESIGNED AND ADJUSTED TO MAINTAIN THE SPECIFIED SLOPE.
10. FOR CROSSINGS UNDER STREAMS, ALL VOID SPACES SHALL BE FILLED BY PRESSURE. THE GROUT MATERIAL SHOULD BE SAND CEMENT SLURRY.
11. SHOULD IT BE NECESSARY TO PROVIDE VARIABLE HEIGHT SKIDS TO ACHIEVE THE LINE AND GRADE AS SHOWN ON THE APPROVED PLANS, THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS OF THE SPIDER DESIGN SHOWING EACH SPACER, INCLUDING ITS HEIGHT, TO THE CITY INSPECTOR PRIOR TO INSTALLING THE CARRIER PIPE.



STEEL CASING PIPE SELECTION CHART						
DUCTILE IRON PIPE SIZE	4"	6"	8"	10"	12"	14"
STEEL CASING PIPE SIZE	12"	14"	16"	18"	20"	24"


**city of
greenville**
 ENGINEERING DIVISION

STEEL ENCASEMENT AND CARRIER PIPE

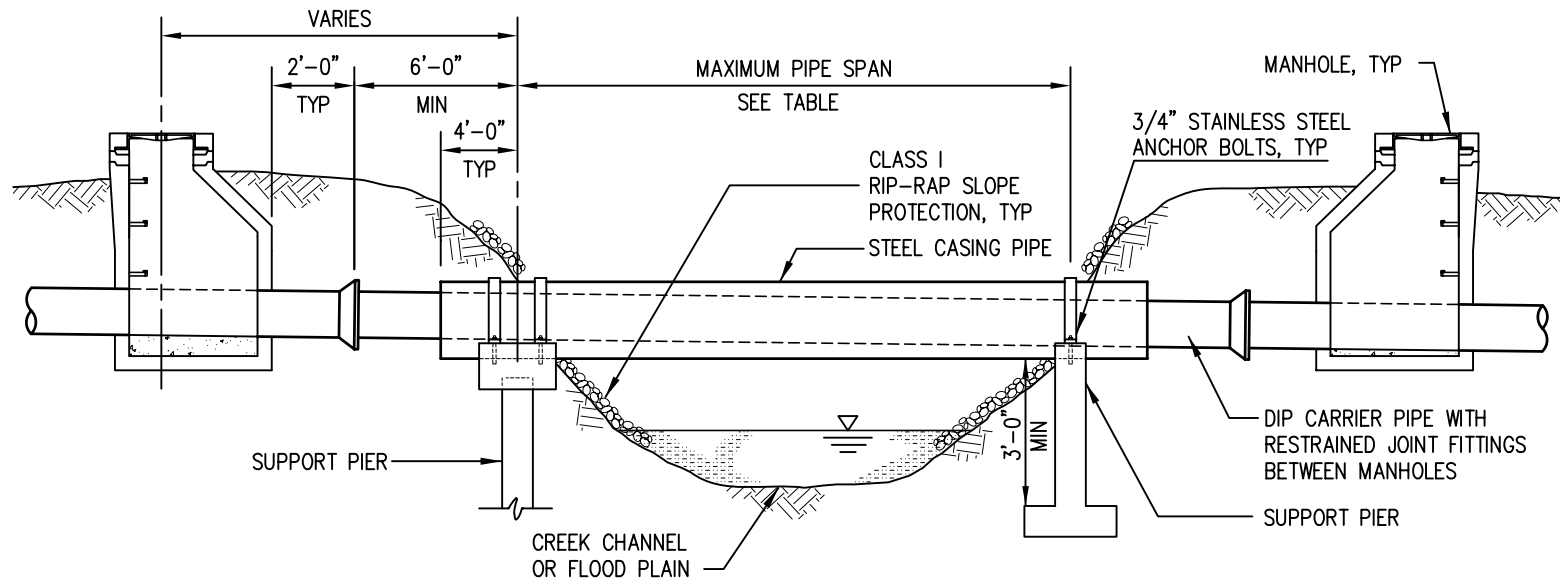
DATE APPROVED: JUNE 2010

OFFICE OF THE
CITY ENGINEER:

Philip B. Lindsey

SCALE:
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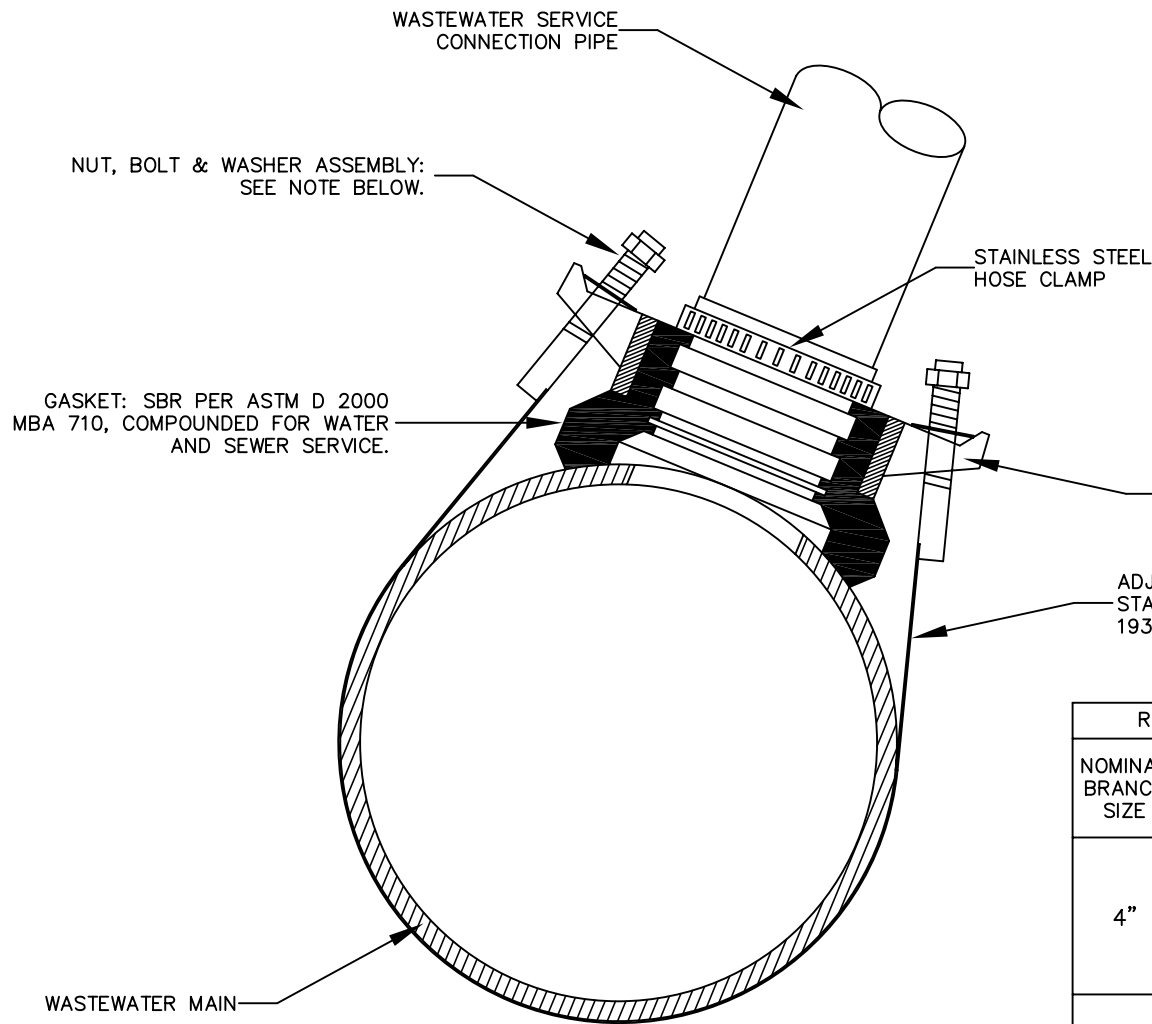


ALLOWABLE SPANS FOR STEEL CASING PIPE

CARRIER PIPE, DIP DIAMETER (IN.)	CASING PIPE, STEEL DIAMETER (IN.)	MINIMUM CASING PIPE WALL THICKNESS (IN.)	ALLOWABLE SPAN (FT.)
6	14	0.2500	40
8	16	0.2500	45
10	18	0.3125	50
12	20	0.3125	50
14	24	0.3125	55
16	26	0.3750	55
18	30	0.3750	60
20	32	0.3750	60
24	36	0.4375	65
30	42	0.4375	65
36	48	0.4375	65
42	56	0.5000	65

NOTE

1. STEEL CASING PIPE SHALL BE TYPE S (SEAMLESS), GRADE B, PLAIN AND BEVELED, WITH A MINIMUM YIELD STRENGTH OF 35,000 PSI AND MANUFACTURED IN ACCORDANCE WITH ASTM A53.
2. STEEL CASING PIPE SHALL BE FURNISHED IN 20' LENGTHS AND ALL JOINTS SHALL BE WELDED IN ACCORDANCE WITH AWWA C206.
3. STEEL CASING PIPE SHALL BE CATHODICALLY PROTECTED IN CONFORMANCE WITH CITY OF GREENVILLE SPECIFICATIONS.
4. STEEL CASING PIPE SHALL HAVE MINIMUM WALL THICKNESS FOR THE ANTICIPATED SPAN AS SHOWN IN THIS DETAIL.
5. THE BOTTOM OF THE CASING PIPE SHALL BE PLACED NO LOWER THAN THE ELEVATION OF THE 50 YEAR FLOOD.
6. ALL CARRIER PIPE JOINTS SHALL BE RESTRAINED JOINTS IN CONFORMANCE WITH CITY OF GREENVILLE STANDARD DRAWINGS AND SPECIFICATIONS.
7. THE CARRIER PIPE SHALL BE SUPPORTED BY 316 STAINLESS STEEL OR GALVANIZED STEEL WITH COAL TAR EPOXY SPACING "SPIDERS" IN CONFORMANCE WITH CITY OF GREENVILLE STANDARD DRAWINGS AND SPECIFICATIONS.
8. ADDITIONAL STEEL ENCASEMENT AND CARRIER PIPE REQUIREMENTS PER CITY OF GREENVILLE STANDARD DRAWINGS AND SPECIFICATIONS.
9. PIERS AND ALL APPURTENANCES THERETO REQUIRE STRUCTURAL ANALYSIS OF HORIZONTAL AND VERTICAL STABILITY BY A SOUTH CAROLINA PROFESSIONAL ENGINEER.
10. ALL REASONABLE EFFORT SHALL BE MADE TO THE SATISFACTION OF THE CITY ENGINEER TO MINIMIZE THE NUMBER OF PIERS LOCATED WITHIN THE FLOODWAY.



NOTE

1. ALL WORK TO BE COMPLETED IN ACCORDANCE WITH CITY OF GREENVILLE SPECIFICATIONS.
2. ALL SERVICE CONNECTIONS SHALL BE INSPECTED BY THE CITY OF GREENVILLE PLUMBING INSPECTOR.
3. THE APPLICATION SHOWN HERE IS ONLY FOR TAPPING EXISTING LIVE WASTEWATER MAINS.
4. TAPPING SADDLE SHALL BE ROMAC INDUSTRIES TYPE CB SEWER SADDLE OR APPROVED EQUAL. ALTERNATES SHALL BE PRE-APPROVED BY THE CITY OF GREENVILLE PRIOR TO INSTALLATION.
5. CARE SHALL BE TAKEN TO PROHIBIT NEW CONNECTION FROM ENTERING INTO EXISTING PIPE.
6. HAMMER TAPS ARE PROHIBITED. EXISTING PIPE SHALL BE CORED AND REMAINDER SHALL BE PROPERLY DISPOSED.

SADDLE CASTING: DUCTILE IRON PER ASTM 536, GRADE 65-45-12. PROTECTED WITH SHOP COAT.

ADJUSTABLE STRAP: 3 1/2" WIDE, STAINLESS STEEL PER ASTM A 193, TYPE 304

ROMAC INDUSTRIES, INC. STYLE CB SEWER SADDLE - 1-800-426-9341

NOMINAL BRANCH SIZE	NOMINAL MAIN SIZE	RANGE	BRANCH TYPE	BRANCH O.D.	CATALOG NUMBER
4"	6"-12" (48" STRAP)	6.27-14.40 (REGULAR GASKET)	UNIVERSAL ¹ (PVC SDR 35 & SCH. 40)	4.20-4.63	CB-4.63UN
			DUCTILE IRON PIPE	4.8	CB-4.80
	14"-24" (96" STRAP)	14.40-25.80 (LARGE O.D. GASKET)	UNIVERSAL ¹ (PVC SDR 35 & SCH. 40)	4.20-4.63	CB-4.63UNLS
			DUCTILE IRON PIPE	4.80	CB-4.80LS
6"	8"-12" (48" STRAP)	8.00-14.40 (REGULAR GASKET)	UNIVERSAL (PVC SDR 35 & SCH. 40)	6.27-6.66	CB-6.66UN
			DUCTILE IRON PIPE	6.90	CB-6.90
	14"-24" (96" STRAP)	14.40-25.80 (LARGE O.D. GASKET)	UNIVERSAL (PVC SDR 35 & SCH. 40)	6.27-6.66	CB-6.66UNLS
			DUCTILE IRON PIPE	6.90	CB-6.90LS

1. SPECIFIC SADDLES FOR PVC SDR 35 AND SCH. 40 MAY BE USED IN LIEU OF A UNIVERSAL TYPE SADDLE.

NUT, BOLT & WASHER ASSEMBLY:

NUTS TO BE STAINLESS STEEL PER ASTM A 194, TYPE 304. BOLTS TO BE 1/2" UNC ROLLED THREAD, LUBRICANT COATED, STAINLESS STEEL PER ASTM A 193, TYPE 304. WASHERS TO BE STAINLESS STEEL PER ASTM A 240, TYPE 304 AND PLASTIC LUBRICATING WASHERS.

 **city of
greenville**
ENGINEERING DIVISION

SADDLE CONNECTION FOR LIVE WASTEWATER MAINS

DATE
APPROVED: **JUNE 2010**

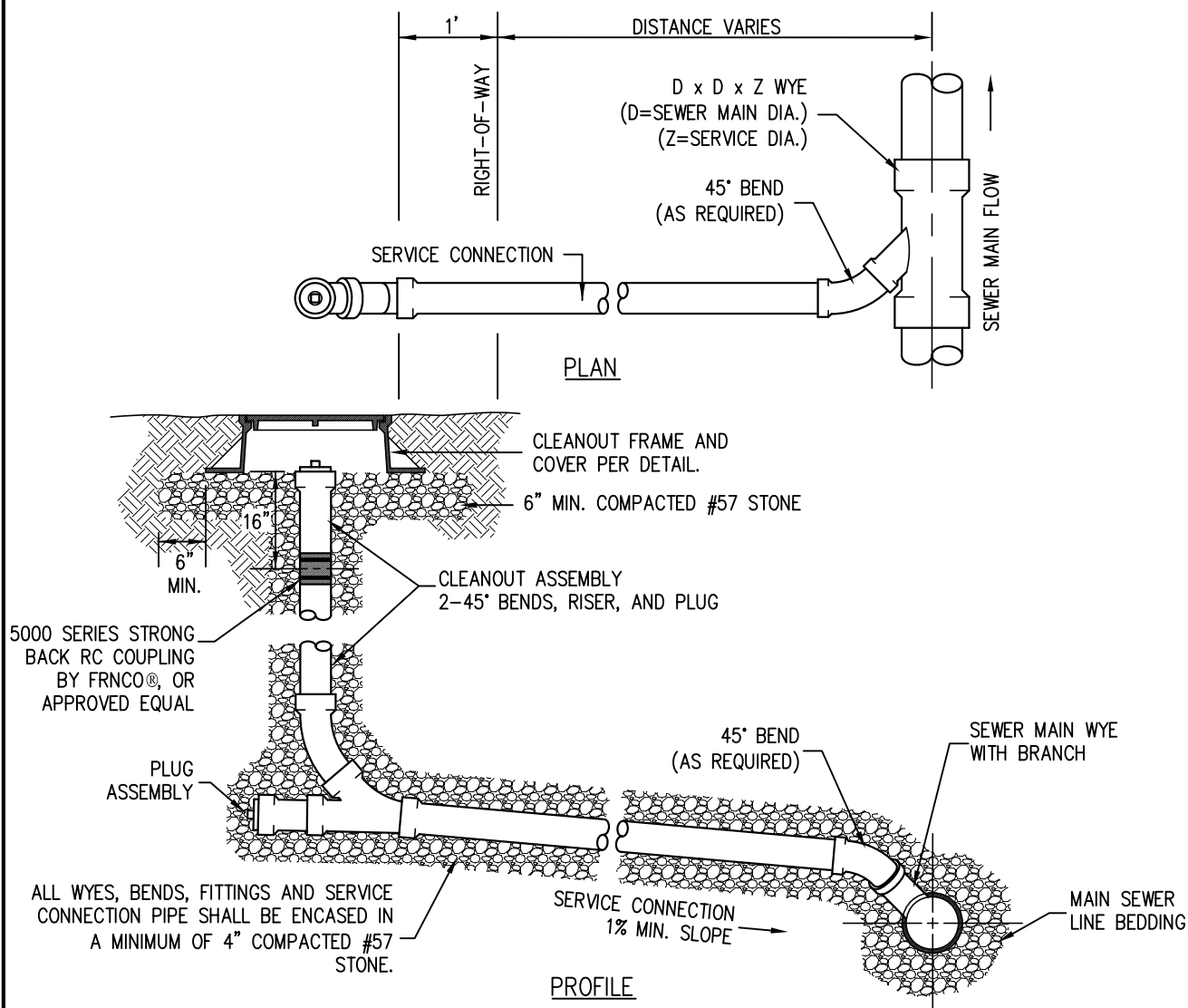
OFFICE OF THE
CITY ENGINEER:

Philip B. Lindsey

SCALE:
NO SCALE

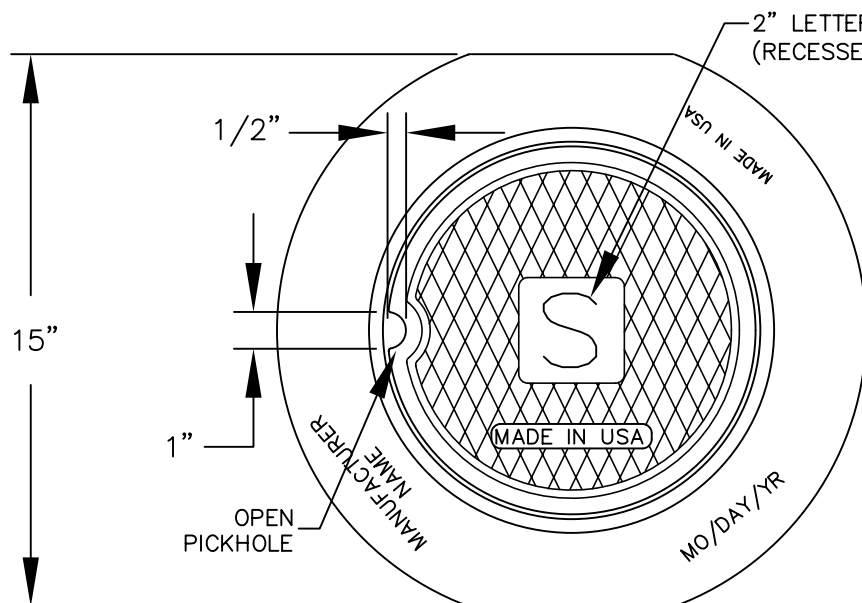
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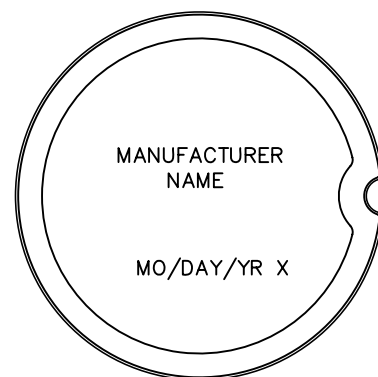


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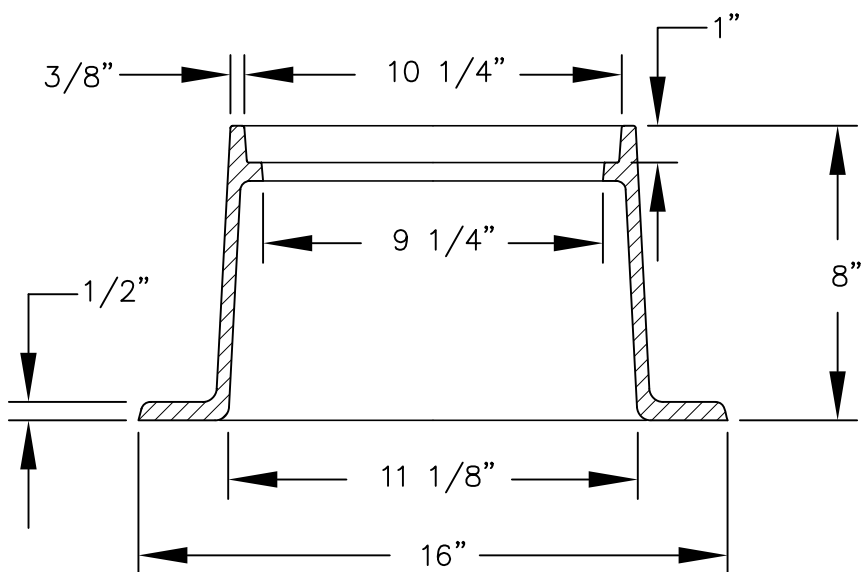
1. SERVICE CONNECTION DETAIL IS FOR THE INSTALLATION OF A NEW SERVICE CONNECTION STUB OUT AS PART OF A NEW MAIN SEWER LINE INSTALLATION. CONNECTIONS TO EXISTING SEWER LINES OR CONNECTION OF THE BUILDING DRAIN TO THE SERVICE CONNECTION STUB OUT SHALL BE INSTALLED PER THE INTERNATIONAL PLUMBING CODE (IPC) OR INTERNATIONAL RESIDENTIAL CODE (IRC) AS APPROPRIATE.
2. WHEN THE BUILDING SEWER IS EXTENDED FROM THE STUB OUT TO THE BUILDING DRAIN, THE BUILDING SEWER AND ITS APPURTENANCES SHALL BE PERMITTED THROUGH AND INSPECTED BY THE CITY OF GREENVILLE BUILDING CODES DIVISION.
3. WITHOUT PRIOR KNOWLEDGE OF THE VARIABLES REQUIRED TO SIZE THE SERVICE CONNECTION PER THE IPC OR IRC, THE MINIMUM DIAMETER OF THE SERVICE CONNECTION STUB OUT SHALL BE MINIMUM FOUR (4) INCH DIA. FOR SINGLE FAMILY RESIDENTIAL AND MINIMUM SIX (6) INCH DIA. FOR COMMERCIAL AND MULTIFAMILY DEVELOPMENT.
4. MINIMUM SLOPE OF THE SERVICE LATERAL IS 1.0% OR $\frac{1}{8}$ " PER FOOT.
5. THE SERVICE CONNECTION STUB OUT AND ITS APPURTENANCES SHALL BE OF THE SAME MATERIAL AS THE MAIN SEWER LINE.
6. SERVICE CONNECTION SHALL BE MADE WITH ONE (1) WYE FITTING. THE LONG BRANCH OF THE WYE SHALL HAVE THE SAME INSIDE DIAMETER AS THE WASTEWATER MAIN. TEE FITTINGS ARE NOT PERMITTED.
7. THE WYE FITTING SHALL BE SET BETWEEN THE 10 AND 2 O'CLOCK POSITIONS ALONG THE MAIN SEWER LINE PIPE CIRCUMFERENCE.
8. NO BENDS GREATER THAN 45° SHALL BE USED IN SERVICE CONNECTION INSTALLATION.
9. SERVICE CONNECTIONS SHALL BE A MINIMUM OF THREE (3) FEET FROM PIPE JOINT OR MANHOLE, MEASURED FROM THE NEAREST EDGE OF THE WYE FITTING.
10. CONNECTIONS SHALL BE POSITIONED ALONG THE MAIN SEWER LINE TO PROVIDE AN INDIVIDUAL, SEPARATE AND DIRECT CONNECTION FROM THE STRUCTURE TO THE WASTEWATER MAIN. CONNECTIONS SHALL NOT CROSS ADJACENT LOT PROPERTY LINES.
11. A SERVICE CONNECTION CLEANOUT SHALL BE INSTALLED ONE (1) FOOT FROM THE RIGHT-OF-WAY LINE OR EASEMENT BOUNDARY WITH A CLEANOUT FRAME AND COVER PER DETAIL.
12. SERVICE CONNECTION SHALL BE PLUGGED TO PREVENT INFILTRATION AND SEDIMENTATION OF THE LINE.
13. SERVICE CONNECTIONS SHALL NOT BE CONNECTED TO A NEWLY CONSTRUCTED MAIN SEWER LINE UNTIL A PERMIT TO OPERATE (PTO) HAS BEEN OFFICIALLY ISSUED BY SCDHEC. CONTACT CITY OF GREENVILLE ENGINEERING (467-4400) WITH ANY QUESTIONS.



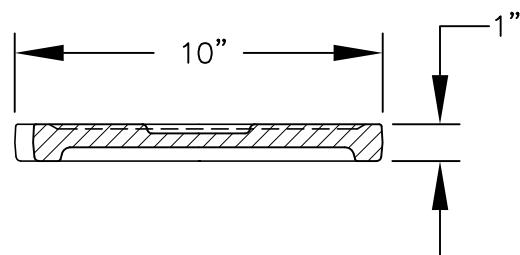
TOP VIEW



BOTTOM VIEW OF COVER



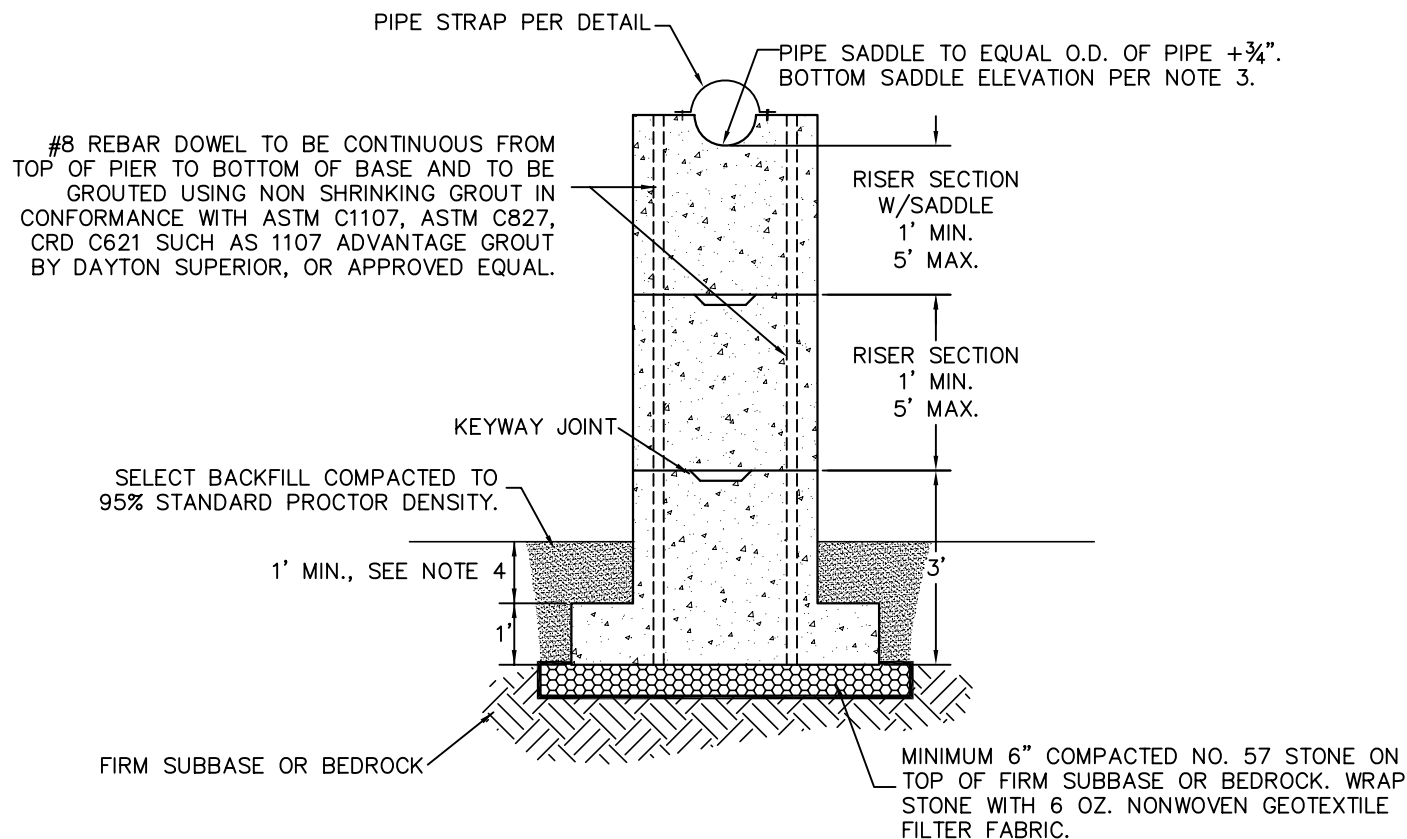
FRAME SECTION



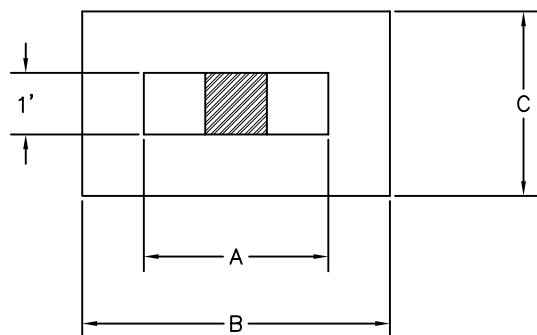
COVER SECTION

NOTE

1. ALL GRAY IRON CASTINGS SHALL CONFORM TO ASTM A48 CL35B AND SHALL BE OF UNIFORM QUALITY.
2. ALL CASTINGS SHALL BE UNDIPPED.
3. ALL CASTINGS SHALL HAVE THE FOLLOWING AVERAGE WEIGHTS:
FRAME: 39 LBS.
COVER: 14 LBS.
TOTAL: 53 LBS.
4. ALL CASTINGS SHALL BE H-20 TRAFFIC RATED.
5. CASTINGS SHALL BE EJIW UNIT NO. 1566, OR APPROVED EQUAL.



SECTION

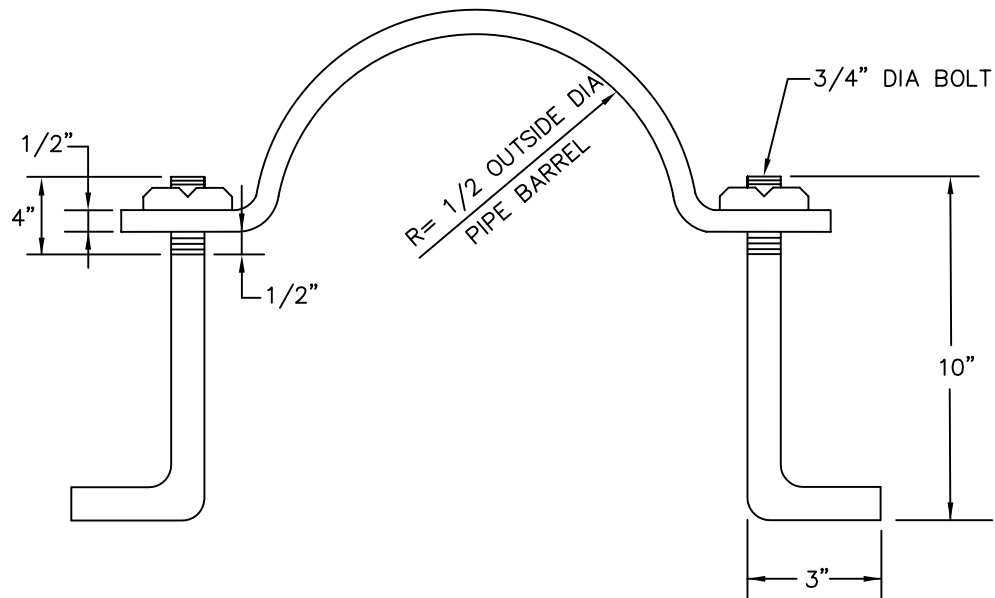


PIPE SIZE	A	B	C
8", 10", 12" & 14"	3'	5'	3'
16" - 24"	4'	6'	3'

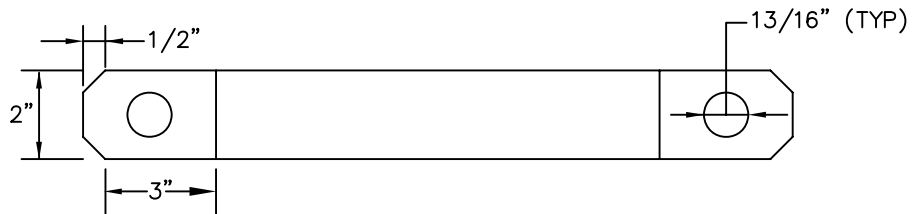
PLAN

NOTE

1. THIS DETAIL IS ONLY APPLICABLE FOR INDIVIDUAL SERVICE CONNECTIONS WITH SHORT SPANS. ALL OTHER CROSSINGS MUST BE DESIGNED AND INSTALLED IN ACCORDANCE WITH OTHER CITY STANDARDS FOR AERIAL CROSSINGS.
2. AERIAL SEWER SERVICE CONNECTION PIPE MUST BE DUCTILE IRON PIPE WITH RESTRAINED JOINTS IN CONFORMANCE WITH CITY OF GREENVILLE REGULATIONS.
3. BOTTOM SADDLE ELEVATION TO BE NO LOWER THAN THE ELEVATION OF THE 50 YEAR FLOOD, OR AS DIRECTED BY THE CITY ENGINEER.
4. MINIMUM COVER TO BE DETERMINED BY GEOTECHNICAL ENGINEER TO ENSURE HORIZONTAL AND VERTICAL STABILITY.
5. STEEL PIPE CASING WITH SPACERS PER CITY DETAILS MAY BE USED TO SPAN LONGER DISTANCES.
6. PRECAST CONCRETE SHALL BE MIN. 4000 PSI.
7. REINFORCEMENT TO MEET ASTM A615.
8. SECTIONS SHALL HAVE RECESSED STEEL HOOKS FOR LIFTING.
9. ALTERNATE PIER DESIGN MUST BE REVIEWED BY THE CITY ENGINEER.
10. PIERS BY MST CONCRETE PRODUCTS (864-639-2894), OR APPROVED EQUAL.



ELEVATION



PLAN

NOTE

1. ANCHOR BOLTS AND STRAPS SHALL BE GALVANIZED AND HOT ASPHALT DIPPED.
2. HOLES TO BE DRILLED IN STRAP.
3. PROVIDE WASHERS UNDER STRAP SUCH THAT STRAP IS PULLED DOWN TIGHT.

1. THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL UNDERGROUND UTILITIES BY CALLING PALMETTO UTILITY PROTECTION SERVICE AT 811 THREE (3) DAYS PRIOR TO CONSTRUCTION.
2. THE CONTRACTOR SHALL CONTACT THE CITY OF GREENVILLE, CONSTRUCTION INSPECTION BUREAU, (864) 467-8890, A MINIMUM OF 72 HOURS PRIOR TO ANY CONSTRUCTION ACTIVITY.
3. THE CONTRACTOR SHALL PROVIDE THE CONSTRUCTION INSPECTION BUREAU AND THE ENVIRONMENTAL ENGINEERING BUREAU WITH A CURRENT CONSTRUCTION SCHEDULE PRIOR TO CONSTRUCTION.
4. THE CONTRACTOR IS RESPONSIBLE FOR CONDUCTING ALL WORK IN ACCORDANCE WITH THE LATEST REQUIREMENTS OF THE OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION.
5. ALL MATERIALS AND CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE STANDARD DETAILS AND SPECIFICATIONS OF THE CITY OF GREENVILLE, SOUTH CAROLINA AND ALL OTHER APPLICABLE GOVERNING AUTHORITIES. BELOW ARE WASTEWATER GENERAL NOTES BUT IN ALL CASES THE CONTRACTOR SHALL REFER TO THE SPECIFICATIONS AND DETAILS FOR ADDITIONAL MORE DETAILED CONSIDERATIONS.
6. ALL TRENCHES WITHIN THE RIGHT-OF-WAY SHALL BE COMPACTED TO 95% OF STANDARD PROCTOR DENSITY AND ALL OTHER TRENCHES SHALL BE COMPACTED TO 90% OF STANDARD PROCTOR DENSITY TO PREVENT SETTLEMENT AND DAMAGE TO PAVING AND PIPELINE. STANDARD PROCTOR TESTING SHALL BE IN CONFORMANCE WITH ASTM D698. ALL FILL IS TO BE FREE OF ROOTS, TRASH, AND ORGANIC MATTER AND SHALL BE PLACED IN 6" LIFTS. NO STONE LARGER THAN SIX (6) INCHES SHALL BE USED AS BACKFILL. FOR TRENCHES OUTSIDE OF A PAVED SURFACE, THE TOP 6" LIFT SHALL BE SCREENED ORGANIC TOPSOIL AND BE PERMANENTLY STABILIZED WITH VEGETATIVE COVER.
7. ALL PVC PIPE SHALL BE SDR 26, SDR 35, OR C900 MEETING ASTM STANDARDS. ALL DIP SEWER PIPE SHALL BE ASPHALT COATED CEMENT MORTAR LINED CLASS 50 DUCTILE IRON PIPE MEETING ANSI/AWWA STANDARDS WITH SPECIAL CONSIDERATION GIVEN TO CORROSIVE AND SEPTIC CONDITIONS. ALL PIPE SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST REVISION OF ASTM D2321 (PVC AND DIP) AND APPLICABLE ANSI/AWWA C600 STANDARDS (DIP) AND IN CONFORMANCE WITH THE STANDARD DETAIL, LATEST REVISION.
8. MANHOLES SHALL HAVE A MINIMUM INSIDE DIAMETER OF FOUR (4) FEET AND BE PRECAST 4000 PSI REINFORCED CONCRETE CONFORMING TO ASTM C-478 WITH PREFORMED OPENINGS. THE MANHOLE SHALL BE CONSTRUCTED WITH A FLOW CHANNEL TO PROVIDE A SMOOTH CONNECTION BETWEEN THE INLET TRIBUTARY AND THE OUTLET PIPE.
9. CONNECTIONS MADE AT MANHOLES SHALL BE NO HIGHER THAN 18" ABOVE MANHOLE INVERT. CONNECTIONS HIGHER THAN 18" ABOVE THE MANHOLE INVERT MUST HAVE AN EXTERNAL DROP CONSTRUCTED PER CITY OF GREENVILLE DETAILS AND SPECIFICATIONS.
10. EACH INDIVIDUALLY OWNED PARCEL AND EACH BUILDING HAVING PLUMBING FIXTURES INSTALLED, WHICHEVER IS APPLICABLE, SHALL HAVE AT LEAST ONE DIRECT AND INDIVIDUAL CONNECTION TO A CITY WASTEWATER MAIN WITHOUT CROSSING ADJACENT PROPERTY LINES.
 - (A.) NEW CONNECTIONS TO AN EXISTING WASTEWATER MAIN THAT IS ACTIVELY CARRYING FLOW SHALL BE ACCOMPLISHED WITH A TAPPING SADDLE - ROMAC INDUSTRIES TYPE CB, OR APPROVED EQUAL.
 - (B.) NEW CONNECTIONS CONSTRUCTED AS PART OF A NEW MAIN INSTALLATION SHALL BE ACCOMPLISHED WITH A WYE FITTING AND SET BETWEEN THE 10 AND 2 O'CLOCK POSITIONS. THE LONG BRANCH OF THE WYE SHALL HAVE THE SAME INSIDE DIAMETER AS THE MAIN. STRAIGHT TEE CONNECTIONS WILL NOT BE ACCEPTED. SERVICE CONNECTION LATERALS SHALL TERMINATE ONE (1) FOOT BEYOND THE RIGHT-OF-WAY OR EASEMENT BOUNDARY WITH A CLEANOUT AND AN AIR/WATER TIGHT PLUG PER THE STANDARD DETAILS.
11. SERVICE CONNECTIONS SHALL BE A MINIMUM OF THREE (3) FEET FROM PIPE JOINTS OR MANHOLES MEASURED FROM THE NEAREST EDGE OF THE WYE FITTING.
12. THE CONTRACTOR SHALL NOT CONNECT SERVICE LATERALS TO EXISTING OR NEW MANHOLES WITHOUT PRIOR WRITTEN APPROVAL FROM THE CITY ENGINEER.
13. THE LOCATION OF THE TERMINUS OF THE SERVICE LATERAL AND CLEANOUT SHALL BE MARKED BY A 2" X 4" TREATED POST PAINTED GREEN DRIVEN A MINIMUM OF THREE (3) FEET AND PROTRUDING APPROXIMATELY THREE (3) FEET ABOVE FINAL GRADE.
14. SANITARY SEWER SERVICE LATERALS SHALL NOT BE CONNECTED TO A NEWLY CONSTRUCTED SANITARY SEWER MAIN UNTIL A PERMIT TO OPERATE HAS BEEN OFFICIALLY ISSUED BY SCDHEC AND RECEIVED BY THE CITY ENGINEER. CONTACT THE CITY OF GREENVILLE ENVIRONMENTAL ENGINEERING BUREAU AT (864) 467-4400 WITH ANY QUESTIONS.
15. PRESSURE AND DEFLECTION TEST TO BE PERFORMED ON ALL LINES AND VACUUM TEST ON ALL MANHOLES IN THE PRESENCE OF A CITY OF GREENVILLE REPRESENTATIVE AND A REPRESENTATIVE OF THE ENGINEER. ALL TESTS SHALL BE IN CONFORMANCE WITH CITY OF GREENVILLE AND SCDHEC SPECIFICATIONS.
16. THE CONTRACTOR SHALL PROVIDE TO THE DESIGN ENGINEER AN AS-BUILT DRAWING OF THE SANITARY SEWER SYSTEM. THE DRAWINGS SHALL, AT A MINIMUM, INCLUDE THE SANITARY SEWER MAIN AND MANHOLE LOCATIONS, PIPE MATERIAL FOR THE MAIN AND THE SERVICE LATERALS, THE DISTANCE OF EACH SERVICE CONNECTION TO THE DOWNSTREAM MANHOLE, LENGTH OF EACH SERVICE LATERAL, AND THE LOCATION AND DEPTH OF EACH SERVICE LATERAL TERMINUS. THE ENGINEER CANNOT APPLY FOR FINAL APPROVAL UNTIL THIS INFORMATION IS OBTAINED FROM THE CONTRACTOR.
17. THERE SHALL BE A 25-FOOT EASEMENT (12.5' EACH SIDE OF CENTERLINE) ESTABLISHED ON ALL WASTEWATER MAINS.



city of
greenville

ENGINEERING DIVISION

WASTEWATER GENERAL NOTES

DATE
APPROVED: JUN. 2010

OFFICE OF THE
CITY ENGINEER:

Philip B. Lindsey

SCALE:
NO SCALE

DETAIL :

29:00

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EROSION PREVENTION AND SEDIMENT CONTROL NOTES

1. The City of Greenville Construction Inspection Bureau needs to be notified at (864) 467-8890 a minimum of 72 hours prior to beginning construction.
2. Sediment and erosion control devices shall be installed and functioning prior to beginning any project earth disturbing activities.
3. All sediment and erosion controls shall be inspected, at the specified inspection frequency, until construction is complete and the site is permanently stabilized.
4. All erosion control devices shall be properly maintained during all phases of construction until the completion of all construction activities and all disturbed areas have been permanently stabilized. Additional control devices may be required during construction in order to control erosion and/or offsite sedimentation. All temporary control devices shall be removed once construction is complete and the site is permanently stabilized.
5. All sediment and erosion control devices shall be inspected every seven (7) days or every fourteen (14) days and within 24 hours of the end of the storm event of 0.5 inches or greater. Damaged or ineffective devices shall be repaired or replaced, as necessary.
6. A stabilized construction entrance shall be installed and maintained on the project site. Storm water inlet protection shall be provided for all inlets (upstream and downstream) within 50 ft. of the construction entrance or disturbance (on both sides of the public roadway).
7. All existing and new storm water structures, affected by this project, shall be inspected and maintained clean of accumulated demolition debris or sediments. The inspection and maintenance of these structures shall be accomplished on the same schedule as the sediment and erosion control devices.
8. Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than fourteen (14) days after work has ceased, except as stated below:
 - Where stabilization by the 14th day is precluded by snow cover or frozen ground conditions stabilization measures must be initiated as soon as practicable.
 - Where construction activity on a portion of the site is temporarily ceased and earth disturbing activities will be resumed within 14 days, temporary stabilization measures do not have to be initiated on that portion of the site.
9. Disposal of all recovered sediments and construction debris shall be in accordance with all applicable City, State and Federal Regulations. No sediment or construction debris shall be flushed down the storm water system.
10. All erosion and sediment control plans and documentation (e.g., certification statements, inspection records, and maintenance records) shall be available on site during construction. All plans and documents shall be updated as required per SC NPDES General Permit SCR100000.
11. During the course of construction activities erosion and sediment controls shall be used to prevent sediment accumulation on public roadways (including street gutters), sediment laden runoff from entering into existing storm water system inlets or depositing on adjacent properties, and airborne dust migration off-site.
12. To secure the project site, locate limits of construction, protect areas that are to remain undisturbed, and prevent migration of construction debris, orange construction fencing shall be installed around areas not requiring silt fencing. Any accumulation of construction debris on public roadways or adjacent properties shall be removed within 24 hours. Care shall be taken when installing

Engineering Division

- construction fencing to not obscure oncoming traffic at intersections, adjacent driveways and the project construction entrance.
13. The contractor must take necessary action to minimize the tracking of mud onto the paved roadway construction areas. The contractor shall daily remove mud/soil from pavement, by sweeping or vacuuming, as may be required.
 14. Provide silt fence and/or other control devices, as may be required, to control soil erosion during utility construction. All disturbed areas shall be cleaned, graded, and stabilized immediately after the utility installation.
 15. Silt fence shall be installed along lines of equal elevation. Silt fencing shall be installed no closer than 5 feet downhill from the toe of any slope.
 16. All Waters of the State (WoS), including wetlands, are to be flagged or otherwise clearly marked in the field. All WoS shall be clearly delineated on the erosion prevention and sediment control plans.
 17. Project setback buffers shall be located a distance from the stream bank equal to five (5) times the width of the stream, measured at the top of the bank, or 20 ft. on each side of the stream, whichever is greater. In the case of a lake or wetlands area the setback buffer shall be a minimum of 50 ft. All setbacks shall be clearly delineated on the erosion and sediment control plans.
 18. A single row of silt fencing shall be installed along all setback buffers that meet the minimum requirements.
 19. A double row of silt fencing shall be installed in all areas where a minimum setback buffer cannot be maintained between the disturbed area and the water body or wetland. Double row of silt fencing shall be placed no closer than 5 ft. downhill from the toe of any fill area and a minimum of 5 ft. spacing shall be maintained between silt fence rows. A 10-foot buffer should be maintained between the last row of silt fence and all water bodies and wetlands.
 20. Stockpiles of useable or waste materials shall be surrounded by a row of silt fence at all times. Stockpiles that are undisturbed for more than fourteen (14) days shall have appropriate stabilization measures installed. Stockpiles shall be placed a minimum of 50 feet away from stormwater flows, stormwater inlet structures, drainage courses, adjacent property and public roadways.
 21. Litter, construction debris, oils, fuels, building products with significant potential for impact (such as stockpiles of freshly treated lumber), and construction chemicals that could be exposed to storm water must be prevented from becoming a pollutant source in stormwater discharges.
 22. Temporary diversion berms and/or ditches will be provided as needed during construction to protect areas from upslope runoff and/or to divert sediment laden water to appropriate traps or stable outlets.
 23. Slopes steeper than 4:1 and/or exceeding eight (8) vertical feet shall be stabilized with synthetic or vegetative mats, in addition to hydro seeding. It may be necessary to install temporary slope drains during construction. Temporary berms may be needed until the slope is brought to grade.
 24. Cat track or surface roughening is required for all slopes greater than 4:1 prior to seeding and lying of synthetic or vegetative mats. Cat tracking or surface roughening shall produce a surface with furrows running cross slope, parallel with slope contours, and perpendicular to surface runoff.
 25. Portable toilet facilities shall not be located within 20 feet of any storm water structure and/or 50 feet of any water course, wetland area, stream, floodplain, or lake.
 26. Residential subdivisions require erosion control features for infrastructure as well as for individual lot construction. Individual property owners shall follow these plans during construction or provide an individual plan meeting section R.72-307 of the Stormwater Management and Sediment Reduction Act.

Engineering Division

27. The site shall be considered permanently stabilized when all surface disturbing activities are complete and either of the two following criteria is met:
- a. A uniform (e.g., evenly disturbed, without large bare areas) perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or
 - b. Equivalent permanent stabilization measures (such as riprap, gabions, or geotextiles) have been employed.
28. Properly signed and sealed as-built drawings of the stormwater plan and a signed and sealed detention basin as-built shall be submitted to the City within 30 days of permanent stabilization and prior to issuance of project acceptance by the City.

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APPENDIX B

DESIGN AND SPECIFICATIONS MANUAL

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appendix B

STORMWATER TECHNICAL REFERENCE MANUAL

Note: This appendix is under construction. This appendix will be the technical reference manual for the preparation of stormwater modeling and erosion control measures as referenced in the stormwater ordinance.

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APPENDIX C

DESIGN AND SPECIFICATIONS MANUAL

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revisions

August 2008: Initial release.

June 2010: Included Stormwater Pollution Prevention Plans by reference only.



appendix C

STORMWATER POLLUTION PREVENTION PLAN TEMPLATES

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Revisions Page	i
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Project Sites Less Than 10 Acres

The latest version of the stormwater pollution prevention plan (SWPPP) template for project sites less than 10 acres may be accessed via the Stormwater Management section of the Environmental Engineering Bureau page on the City of Greenville Engineering Division website found on the world wide web at www.greenvillesc.gov/PublicWorks/Stormwater.aspx.

Project Sites 10 Acres or More

The latest version of the stormwater pollution prevention plan (SWPPP) template for project sites of 10 acres or more may be accessed via the Stormwater Management section of the Environmental Engineering Bureau page on the City of Greenville Engineering Division website found on the world wide web at www.greenvillesc.gov/PublicWorks/Stormwater.aspx.



APPENDIX D

DESIGN AND SPECIFICATIONS MANUAL

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revisions

August 2008: Initial release.

June 2010: Wastewater Utility checklist, inspection forms, and warranty agreement added.

April 2012: Updated wastewater main warranty form and included sample warranty bond.



appendix D

ENGINEERING DIVISION FORMS

Revisions Page	i
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 Wastewater Utility	
Wastewater Construction Permit Application Checklist	I
Wastewater Final Performance Testing Forms and Tables	3
Wastewater Utility Maintenance/Warranty Agreement	5
Wastewater Maintenance/Warranty Period Bond	7



SC DHEC Wastewater Construction Permit Application Checklist City of Greenville Delegated Review Program (DRP)

- ☐ The completed original [SC DHEC Construction Permit Application](#) (DHEC 1970, 03/2008) plus two (2) copies.
- ☐ Application fee of **\$75.00** for a collection/transmission system submitted as a DRP project check. Make check [payable to SCDHEC/Bureau of Finance](#) with the name of the project identified on the check.
- ☐ One (1) complete sanitary plan set.
- ☐ Two (2) copies of the appropriate design calculations, signed and sealed.
- ☐ Two (2) copies of a separate detailed 8 ½" x 11" location map.
- ☐ Two (2) copies of the [letter of flow acceptance](#) from the entity providing treatment of the wastewater. *To obtain a letter of flow acceptance from WCRSA, submit a Preliminary Sanitary Sewer Agency Review Form to the City; the City will complete the appropriate section and return the form and a conditional O&M letter to the design engineer.*
- ☐ Two (2) copies of the 208 Plan [certification from the appropriate Council of Governments](#) (COG) in designated 208 areas or from SC DHEC in non-designated 208 areas.
- ☐ Review and inspection fee. Make check [payable to City of Greenville](#) with the name of the project identified on the check. The following is the current fee schedule based on total length of line:

1 - 300 ft.	\$128.50
301 - 1000 ft.	\$261.00
More than 1000 ft.	\$393.50

Include the following items as applicable to the project –

- ☐ Three (3) copies of construction easements, *unless the project owner has the right of eminent domain or the proposed wastewater system is within an existing easement or the right-of-way.*
- ☐ Two (2) copies of SC DHEC Water Quality Division permit and other applicable agency approvals, *for placement in navigable waters.*
- ☐ Two (2) copies of the letter from the organization agreeing to be responsible for O&M of the wastewater system, *if the City of Greenville will not be responsible for O&M.*

**Submit this completed checklist with application directly to the
City of Greenville, Engineering Division**

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WASTEWATER FINAL PERFORMANCE TEST

Page _____ of _____

Project: _____ DRP Number: _____

Contractor: _____ Engineer: _____

Inspector(s): _____ Date: _____

**All parties shall print names and initial above.*

Begin MH/Sta		End MH/Sta		Pipe		Air Pressure Test		Mandrel Test		
				Length (ft)	Size / Material	Held		PASS	FAIL	N/A
						Pressure (psi)	Time			
Pass	Fail	Pass	Fail							
Pass	Fail	Pass	Fail							
Pass	Fail	Pass	Fail							
Pass	Fail	Pass	Fail							
Pass	Fail	Pass	Fail							
Pass	Fail	Pass	Fail							
Pass	Fail	Pass	Fail							

**Refer to City of Greenville Performance Requirements for manhole and main sewer line testing times.*

**All manholes shall be tested per ASTM C1244 and all main sewer lines per ASTM F1417.*

Notes:



PERFORMANCE REQUIREMENTS

Minimum Specified Time Required for a 1.0 psig Pressure Drop for Size and Length of Pipe Indicated, ASTM F1417

Pipe Diameter (in)	Minimum Time (min:s)	Length for Min. Time (ft)	Time for Longer Length (s)
4	3:46	597	0.380(L)
6	5:40	398	0.854(L)
8	7:34	298	1.520(L)
10	9:26	239	2.374(L)
12	11:20	199	3.418(L)
15	14:10	159	5.342(L)
18	17:00	133	7.692(L)
21	19:50	114	10.470(L)
24	22:40	99	13.674(L)

Note:

1. Testing time shall be measured for the pressure to drop from 3.5 psig to 2.5 psig.
2. Caution must be taken not to over pressurize the system.
3. Pipe is acceptable if the time for the pressure reading to drop from 3.5 psig to 2.5 psig meets or exceeds the minimum listed in column 2.
3. L=length of pipe above the minimum listed in column 3.
Multiply the length (L) by the coefficient given for the additional testing time required.

Minimum Test Times for Various Manhole Diameters, ASTM C1244

Depth (ft)	Diameter (in)		
	48	60	72
	Time (s)		
4 or less	10	13	16
6	15	20	25
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

Note:

1. Testing time shall be measured for the vacuum to drop from 10 in. Hg (4.91 psig) to 9 in. Hg (4.42 psig).
2. Pipe is acceptable if the time for the vacuum reading to drop from 10 in. Hg to 9 in. Hg meets or exceeds the minimum listed in columns 2, 3, or 4, as appropriate.

MAINTENANCE/WARRANTY AGREEMENT FOR

THIS AGREEMENT is dated _____, and is by, between and among the **CITY OF GREENVILLE (“City”)** and _____ (**“Owner”**).

IN CONSIDERATION OF the recitals and the mutual covenants and agreements set forth herein, and pursuant to the requirements of the City, the parties hereto agree as follows:

SECTION 1. RECITALS.

A. On _____, the Owner received a Permit to Construct (**“PTC”**), permit number _____ for the installation of sanitary sewer main and services (**“Improvements”**) more fully shown on the approved **“As-Built”** drawings in connection therewith.

B. The City Engineer has reviewed the Improvements, and has determined that the Owner has satisfactorily installed and completed the Improvements in accordance with the approved PTC.

C. The City Engineer has recommended that a Permit to Operate (**“PTO”**) be issued for the Improvements and that the City assumes ownership and maintenance responsibility of the Improvements as public improvements (**“Public Improvements”**) pursuant to the Land Management Ordinance and the Design and Specifications Manual. These improvements are the _____ more fully shown on the approved **“As-Built”** drawings.

D. The Owner has agreed to enter into this Agreement to warrant, and ensure the maintenance of, all of the Improvements by the Owner for a period of **one year** after the latter of the issuance of the PTO or receipt of fully executed easement documents.

SECTION 2. WARRANTY OF IMPROVEMENTS.

A. Scope of Warranty. The Owner warrants that the Improvements and all of their components shall be free from defects and flaws in design, workmanship, and materials; shall strictly conform to the requirements of the Agreement; and shall be fit, sufficient and suitable for the purposes expressed in, or reasonably inferred from, the Agreement. The warranty herein expressed shall be in addition to any other warranties expressed in this Agreement, or expressed or implied by law, which are hereby reserved unto the City.

B. Length of Warranty; Repairs; Extension of Warranty. The Owner shall, promptly and without charge to the City, correct any failure to fulfill the above warranty that may be discovered or develop at any time within one year after acceptance of the Improvements by the City or such longer period as may be prescribed by law. The above warranty shall be extended automatically to cover all repaired and replacement parts and labor provided or performed under such warranty and the Owner’s obligation to maintain the Improvements shall be extended for a period of one year from the date of such repair or replacement. The time period established in this Subsection B relates only to the specific obligation of the Owner to maintain the Improvements and shall not be construed to establish a period of limitation with respect to other obligations that the Owner has under any other agreement.

SECTION 3. BOND FOR MAINTENANCE WARRANTY.

As security to the City for the performance by the Owner of the Owner's obligations to maintain the Improvements pursuant to and in accordance with this Agreement, the Owner has posted a bond, or acceptable equivalent, in the amount of \$_____ in accordance with the requirements of the City that were in effect at the time of the execution of the Agreement. Such bond shall be released only after the necessary repairs are completed pursuant to Section 2 above and in accordance with the terms of the Land Management Ordinance and the Design and Specifications Manual.

SECTION 4. RIGHT OF ENTRY.

In the event that the Owner fails to fulfill the warranty within the timeframe established by the City, then the Owner, by this Agreement, grants the City or its contractors the right of entry onto its property to bring the Improvements into compliance.

SECTION 5. TERM.

This Agreement may be released upon expiration of the maintenance period in Section 2 above.

CITY OF GREENVILLE:

City Manager

ATTEST:

By:_____

Title:_____

_____:

By:_____

Print Name:_____

Title:_____

ATTEST:

By:_____

Title:_____

**MAINTENANCE/WARRANTY PERIOD BOND FOR SANITARY SEWER SYSTEM
2013-2014 SERIES**

BOND NO.: _____ PRINCIPAL AMOUNT: \$ _____

PROJECT: _____

KNOW ALL MEN BY THESE PRESENTS, that we **(Name & address of developer)**, as Principal, and **(Name & address of surety)**, a corporation duly admitted to conduct business as a corporate surety in the State of South Carolina, as Surety, are held and firmly bound unto the City of Greenville, Post Office Box 2207, Greenville, SC 29602, as Obligee, in the penal sum of \$_____, lawful money of the United States of America, for the payment of which well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, **(Name of developer)** has agreed to maintain, repair, and correct deficiencies associated with the sanitary sewer system" ("Project") as provided for in the attached maintenance/ warranty Agreement ("Agreement").

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall fail to perform in accordance with the terms of the Agreement, the Surety, upon receipt of a written notice of the Obligee stating that the Project has not been maintained, repaired and/or deficiencies have not been corrected, shall pay the Obligee such amount up to the Principal amount of this Bond which will allow the Obligee to perform the work or will reimburse the Obligee for work performed in accordance with the Agreement.

This obligation shall remain in force for the duration of the warranty period including extensions.

Signed, sealed and dated this _____ day of _____, 20____.

WITNESSES:

(Name of Developer)
PRINCIPAL

By: _____
(Name/Title)

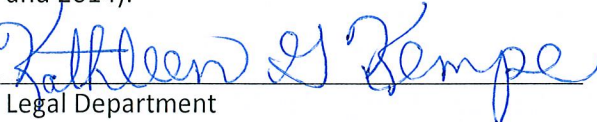
WITNESSES:

(Name of Surety)
SURETY

By: _____
(Name/Title)

Approved as to Form (Signature valid for 2013
and 2014):

Reviewed By:


Legal Department

Engineering



APPENDIX E

DESIGN AND SPECIFICATIONS MANUAL

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revisions

August 2008: Initial release.

June 2010: Added City of Greenville Policy: Rights of Way and Easements Maintenance for Wastewater and Stormwater Systems. Included Stormwater and Lighting Ordinance by reference only.



appendix E

SELECTED CITY ORDINANCES AND POLICIES

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Stormwater Ordinance

The latest version of the stormwater ordinance may be viewed via the online repository municode.com. After navigating to the City of Greenville library, the stormwater ordinance may be found at § 19-7 and Appendices A through H of the Land Management Ordinance.

Lighting Ordinance

The latest version of the lighting ordinance may be viewed via the online repository municode.com. After navigating to the City of Greenville library, the lighting ordinance may be found at § 19-6.4 of the Land Management Ordinance.

City of Greenville Policy

Rights of Way and Easements Maintenance for Wastewater and Stormwater Systems

**CITY OF GREENVILLE POLICY
RIGHT OF WAYS AND EASEMENTS MAINTAINENCE FOR
WASTEWATER & STORMWATER SYSTEMS
DEPARTMENT OF PUBLIC WORKS**

The City of Greenville, under the Wastewater and Stormwater Utilities, is responsible for the maintenance and operation of the wastewater and stormwater collection and conveyance systems. These systems include manholes, pipes, open channels, inlets, catch-basins, and service connections at the main to individual properties. While the City has clear rights to access the parts of the system within either the public Right Of Way (R-O-W) or dedicated easements much of the conveyance system is on private property where the City can not and should not legally enter without first obtaining written permission from the property owner. It should be noted that this may not apply to certain survey activities or activities deemed necessary by the City to protect the public health, safety and welfare.

As a part of the Consent Agreement and Consent Order with EPA the City is required to develop and implement a plan for maintaining accessibility to our wastewater infrastructure for inspection, maintenance and repair. For consistency and for the same maintenance reasons, the same policy should also apply to the City's stormwater infrastructure. This access must accommodate modern equipment such as television trucks, jet and vacuum trucks, excavators, back-hoes and dump trucks. Ideally, the City wishes to locate, to the greatest extent possible, as much of the underground utilities within the public R-O-W or within easements adjacent to the public R-O-W. This not only allows the greatest accessibility to the infrastructure but also greatly reduces the City's effort in maintaining a "Clear Zone" while minimizing the impacts to privately owned properties. With this in mind, the following policy for maintaining the City's underground infrastructure is recommended.

Policy:

The City of Greenville shall maintain to the greatest extent possible a "CLEAR ZONE" above and around its entire wastewater and stormwater infrastructure. This Clear Zone shall ideally be the width of the easement but no less than seven and a half feet (7.5') on either side of the outside edge of the infrastructure. Asphalt paths, concrete sidewalks, roads, parking lots, grass, shrubs and other plantings whose natural height does not exceed three feet are permitted in this "Clear Zone"; however, like all other items not defined for uses in the easement, they are at risk and subject to removal at any time. All other objects, including trees, buildings, fences and other items that would inhibit the City's ability to access and maintain its infrastructure are prohibited.

When installing new infrastructure or replacing existing systems the City of Greenville desires that, whenever possible, wastewater and stormwater systems are located in and adjacent to the Public Road R-O-W. Infrastructure located beyond the R-O-W should be placed in suitable easements sited to maximize the City ability to maintain a "CLEAR ZONE" while minimizing the impacts to private property. These easements should be clearly marked and identifiable and generally run along common property lines.

Written applications for Encroachments into a City Easement may be submitted to the City Engineer for review. This application shall clearly document the location of the easement and associated infrastructure and the size and limits of the encroachment. The City Engineer, at his discretion, may permit or deny activities or allow changes to the width of the easement

City of Greenville Policy
Department of Public Works

and/or “Clear Zone”. The decision shall be based upon best engineering judgment and current engineering standards and construction/maintenance practices.

Definitions:

Clear Zone: An area over the underground infrastructure where access must be preserved in order for the City to effectively maintain the public underground infrastructure. As such, objects such as large trees, fences, buildings, etc. which interfere with the City’s ability to access and maintain the wastewater and stormwater systems are prohibited. Generally this Clear Zone is the total width of the easement; however, where possible it should never be less than fifteen feet in width, centered on the underground system.

Easement: A portion of property dedicated for a particular use, in the case of wastewater and stormwater, conveying sewerage through the property. The dedication can be general, i.e. a Utility Easement where any utility can locate their infrastructure, or specific, a Wastewater Easement to the City of Greenville where only wastewater infrastructure can be placed in the easement and the City has the right to allow or deny other wastewater providers use of the easement. The property owner maintains ownership of the easement area but has given certain rights, including access for inspection and maintenance, in this area. The property owner has also forfeited certain rights to utilize this area for consideration of the public utility, including placing a structure or fence in the area.

The table below outlines the minimum acceptable easement widths. These minimum widths are centered on the underground pipe and based on pipe size, depth of bury and compliance with OSHA requirements.

MINIMUM EASEMENT REQUIREMENTS					
Pipe Size	Bottom Width	Trench Depth			
		4’ and less	4’ to 7’	7’ to 10’	10’ and deeper
8” to 12”	3.0 feet	15’	15’	20’	25’
15” to 24”	4.0 feet	15’	20’	20’	25’
27” to 36”	5.0 feet	20’	20’	20’	25’
42” to 48”	6.0 feet	20’	20’	25’	30’
> 48”	Pipe OD plus 30’ (15’ either side of the outside of the pipe)				

The City may require larger easement widths where the City deems necessary to access and maintain its infrastructure. Reasons for a larger easement include but are not limited to remote locations, adverse slopes, poor site conditions etc.

Generally there are three types of easements:

Platted Easement: During the subdivision of a parcel the City requires a surveyed drawing of the parcel showing existing and new lot lines, road R-O-Ws, and easements. If the City currently has infrastructure or new infrastructure is planned for the subdivision an appropriate easement is dedicated and shown on the plat.

City of Greenville Policy
Department of Public Works

Descriptive Easement: If new easements are required or obtained rather than replatting a property a descriptive easement attached to the plat is used. Referencing the existing plat this type of easement uses meets and bounds (distances and bearings) to describe an easement without actually producing a drawing.

Prescriptive Easement: This is an unwritten/undocumented easement based on the City having and maintaining public infrastructure on private property. This easement is ambiguous and often requires legal interpretation and court action to settle the existence of and actual size. Generally it requires that the City has documented maintenance activities, there is some evidence of the infrastructure that a reasonable person would notice and that the improvements have existed for a certain period of time. The actual width of the easement is also questionable as some courts have ruled that the easement is restricted to the edge of (or outside diameter) of the infrastructure while other rulings have been more liberal allowing for not only the infrastructure but also a reasonable area for access and equipment.

Right of Way (R-O-W): The portion of land owned by a governmental agency, City, County, State, etc., for the construction and maintenance of public streets, roads and public access or rights-of-way. Other public/private agencies may locate infrastructure, such as water mains, oil and gas pipelines, telecommunication lines, power lines, and sewer mains, in this area; however, these other agencies are subject to the authority and wishes of the governmental agency's controlling this property. In general the following order of hierarchy is given to underground utilities:

- 1) Gravity Flow Systems
 - a. Stormwater – Largest pipes under gravity flow
 - b. Wastewater – Second largest pipes under gravity flow
- 2) Pressure Flow Systems
 - a. Wastewater and Stormwater – Largest pipes under pressure flow
 - b. Potable Water
 - c. Natural Gas/Petroleum
- 3) Conduit Systems
 - a. Electric Power
 - b. Telephone and Communication
 - c. Television

This order of hierarchy or precedence is based on pipes size type of operation with preference given to the larger pipes operating under gravity flow first, pipes operating under pressure flow second and pipes acting as conduit with pulled systems last. Priority is also given to essential systems that are necessary for living in an urban area such as water, wastewater and power.

City of Greenville Policy
Department of Public Works

Goals:

1. Install new and/or relocate existing wastewater and stormwater systems into or adjacent to the Public R-O-W whenever possible.
2. Address maintaining a "Clear Zone" above infrastructure outside the R-O-W on publicly owned property before attempting to address infrastructure outside the R-O-W on privately owned property. Utilize these activities to further refine the Clear Zone Policy
3. Disseminate information to property owners about the rights, restrictions and encumbrances on their property, noting the location of the City underground infrastructure on their property and the associated easement(s).
4. With a refined Clear Zone Policy and the necessary easements implement the policy on private property.

The City's primary goal in locating new and maintaining existing infrastructure should be to install or relocate wastewater and stormwater systems into the Public R-O-W whenever possible. However, due to such things as topography, available land and cost, not all wastewater and stormwater infrastructure can be feasibly located in and adjacent to the R-O-W. For those segments not in or near the road, accessibility requirements must be balanced with property impacts. These impacts could include such items as tree loss, building removal, fence demolition and the perception that the City is condemning private property. In order to gain a better understanding of the results of maintaining a "Clear Zone" a focus should be given to segments located on public property, allowing to City the greatest freedom to experiment with a variety of options that balance the needs with the impacts. Therefore the second goal should be to address maintaining a "Clear Zone" above infrastructure outside the R-O-W on publicly owned property before attempting to address infrastructure outside the R-O-W on privately owned property.

While the City focuses on relocating infrastructure to the R-O-W and addressing infrastructure on publicly owned property information regarding the infrastructure on privately owned should be disseminated. Individual property owners should be notified of the location size and type of infrastructure as well as the type of easement on their property as wells their rights and the rights of City to own and operate the public infrastructure.

**City of Greenville Policy
Department of Public Works**

Course of Action:

Define the Infrastructure:

1. Utilizing the GIS, first determine the length and location of all parts of the system differentiating between infrastructure located within the public R-O-W and infrastructure located outside of the public R-O-W.
2. For that infrastructure located outside the R-O-W determine which of the following exist:
 - a. Platted Easements
 - b. Descriptive Easements
 - c. Prescriptive Easements
 - d. No Easements
3. Develop a GIS Layer titled "EASEMENT" and plot the existing easements.

For Infrastructure within and adjacent to the Public R-O-W:

1. No Action – A "Clear Zone" allowing access to the City's infrastructure already exists and the City's goal is met. The only maintenance activity is raising manhole access covers to the surface.

For Infrastructure outside the R-O-W:

1. Determine current condition of the infrastructure.
 - a. On a five point scale rate the underground infrastructure as follows
 - i. "5" – New
 - ii. "4" – Good (no problems)
 - iii. "3" – Average (minor cracks, slight mis-alignments, no action is needed currently)
 - iv. "2" – Poor (system is operating but major problems exist and a action plan needs to be put together and implemented)
 - v. "1" – Failed (system is not functioning and immediate attention is required)
 - vi. "0" - Retired
2. Determine if the infrastructure can be relocated to the Public R-O-W
 - a. For the segments where relocation is an option develop a construction plan and schedule for relocating the infrastructure.
 - b. This plan should prioritize the segments based on such things as age, capacity, condition, and location, as well as the cost of relocation verses the cost of continued maintenance outside the R-O-W.
3. Implement the relocation plan as part of the City's annual replacement and new extension programs with the City construction forces. The extent of the relocation will be based on the annual budget for wastewater extensions and replacements.

City of Greenville Policy
Department of Public Works

For Infrastructure outside the R-O-W that cannot be relocated:

1. Determine if the infrastructure is on Public or Private Property.
2. Initially for underground infrastructure located on Publicly Owned Property ONLY establish the "Clear Zone" working closely with the other City Departments to minimize the disruptions and maximize the benefits by investigating the following:
 - a. Determining an appropriate method for and the necessary steps needed to evaluate removal of existing trees in the Clear Zone. Include the following:
 - i. Working with City Arborist to determine the overall health of the tree.
 - ii. Removing evasive, non native species in favor of desired local trees
 - iii. Protecting heritage trees.
 - iv. Tree replacement along the edge of the Clear Zone to mitigate the trees removed from the Clear Zone
 - v. Consideration of relocating the underground infrastructure.
 - b. Installing multi-use paths that can be used by pedestrians, bicyclists and City crews to access the underground infrastructure with TV trucks, Vactor and Jet Rod trucks.
 - c. Tree planting along the edge of the Clear Zone to help define the City's easements and reduce the potential of tree growth in the Clear Zone
 - d. Other Ideas
3. Utilize these activities to refine the policy and procedures before working on Private Property

For Infrastructure on private property that cannot be relocated to the R-O-W:

1. Notify property owners of the existence of wastewater/stormwater infrastructure and associated easement on their property (Platted, Descriptive, Prescriptive or None)
2. With Platted and Descriptive Easements notify the property owner of the following
 - A) City's Rights under this easement
 - B) Owner's Restrictions under this easement
 - C) Include a map of the property with the infrastructure and the easements clearly plotted and defined.
3. With Prescriptive Easement notify the property owner of the following:
 - A) City's Rights under this easement
 - B) Owner's Restrictions under this easement
 - C) Include a map of the property with the infrastructure and the desired easements clearly plotted and defined.
 - D) The City's desire to obtain a platted or descriptive easement and initiate negotiations for obtaining the easement

City of Greenville Policy
Department of Public Works

4. With No Easement notify the property owner of the following:
 - A) The location of the City's infrastructure
 - B) The City's desire to obtain a platted or descriptive easement and initiate negotiations for obtaining the easement
 - C) Include a map of the property with the infrastructure and the desired easements clearly plotted and defined.
5. Obtain the necessary easements to allow the City to legally enter private property to maintain the public infrastructure.
6. With a final plan for establishing and maintaining a Clear Zone, refined from working on publicly owned property, implement the Clear Zone on privately owned property.

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